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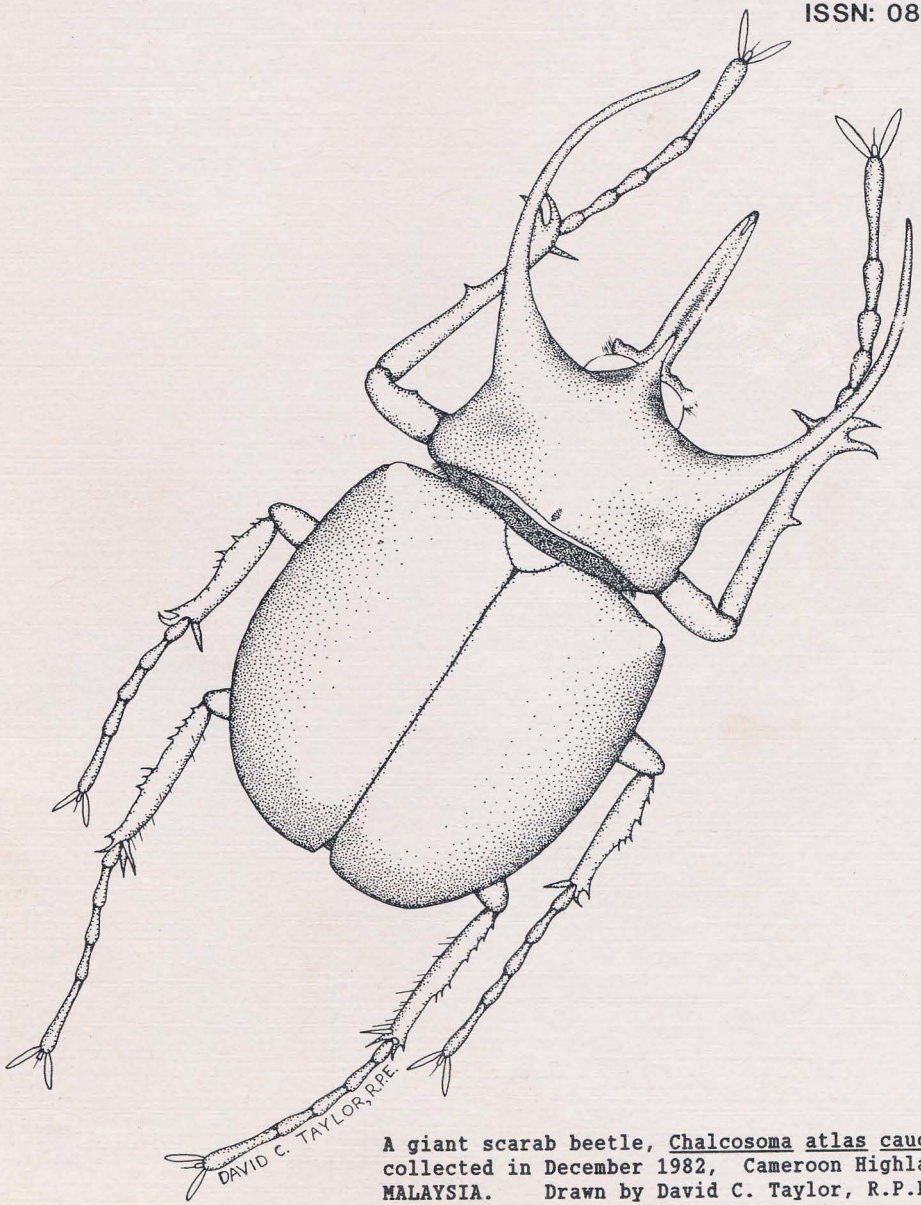

A giant scarab beetle, Chalcosoma atlas cauceus, collected in December 1982, Cameroon Highlands, MALAYSIA. Drawn by David C. Taylor, R.P.E.

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Y.E.S. QUARTERLY

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NEWS SOCIETY NEWS & BUSINESS

I would like to bring members and readers of Y.E.S. QUARTERLY up to date on some important Society business. More than ever before, there is a great deal of activity at Y.E.S. International Headquarters!

A.E.S./Y.E.S. FIELD DAY. Make your plans now to attend the first American Entomological Society/Young Entomological Society field day to be held on Saturday June 6, 1987. We will gather for collecting and other activities at the Myrick Conservation Center near West Chester, Pennsylvania (USA) beginning at 10:00 AM. All interested entomologists are invited to attend. For detailed information on lodging and directions write to Harold B. White, 103 Radcliffe Dr., Newark, DE 19711 USA. Hope to see YOU there!

T.I.E.G. PUBLICATION GIVEAWAY! After many years of trying to sell back issues of T.I.E.G. Magazine (the predecessor to Y.E.S. QUARTERLY), I have finally decided to give them away for the asking. We are in desperate need of the storage space they occupy, so I will send out copies of any publications we have in stock absolutely free of charge. This offer will last only as long as the supply holds out, so get your requests in soon. First come, first serve and I can't guarantee what issues you'll receive (but if you have special needs for missing back issues, I'll do the best that I can).

SPECIAL PROGRAM FOR SPONSORING Y.E.S. MEMBERS? Larry Kopp and I have talked about the possiblility of starting a program where prospective Y.E.S. members who would have difficulty paying their dues could be sponsored (have dues paid) by active Y.E.S. members, in exchange for entomological specimens or possibly other publications/memberships. I think this is an excellent idea. In fact, I know of several Y.E.S. members who on their own have arranged to exchange Y.E.S. dues payments for specimens or membership in other organizations. This is one easy way to solve problems with currency exchange, and I whole-heartedly endorse the idea.

I would be more than delighted to offer the services of Y.E.S. International Headquarters to act as a clearinghouse for this kind of a service program. I would need the assistance of interested Y.E.S. members in two areas: (1) gather names and interests of prospective sponsors and (2) identify prospective members who would benefit from this kind of arrangment. If you have information relative to either of these two needs, please write to me (Gary A. Dunn) at Y.E.S. International Headquarters. I will assemble lists of prospective participants and attempt to make matches between interested sponsors and prospective members.

NEW Y.E.S. SUSTAINING MEMBERS

I would like to take this opportunity to acknowledge the support given by new and continued sustaining members. Without their generous assistance many of the Y.E.S. programs and services we take for granted would not be possible. On behalf of all our members, THANK YOU!

John Reichel, Revelstoke, B.C. (CANADA)

Mack Shotts, M.D., Paragould, AR (USA)

Salsi Stefano, Reggio Emilia, ITALY

CHANGES TO THE 1987 MEMBERSHIP LIST

Please make a note of the following additions and/or corrections to your copy of the 1987 Y.E.S. Member Directory:

Robert Dirig (697-NY-3A) - address should read: 312 North Geneva St. #3

Elvira Barchet (014-CA-3A) - correct address is: 6644 Clybourn Ave. #76, North Hollywood, CA 91606 USA. Field of interest: Cerambycidae (worldwide), systematic & faunistic; Carabidae: Carabus. C, E, D.

Roy F. Morris II (823-GA-3A) - change of address: 210 Southland Station Drive, Apt. 3, Warner Robins, GA 31088 USA.

ERRATA: Y.E.S. QUARTERLY 4(1)

The following error was made in Joan Scancarelli's article, "Monarch Magic", Y.Q. 4(1): p. 36. The last sentence should have read: "However, we can be sure that the offsprings of some of these adults will instinctively return 'home' next spring, beginning another cycle of life." Also, it should be noted that the chrylasis has gold dots.

My apologies to the author for the inconvenience.

Gary A. Dunn, Editor

EUROPEAN PINE SAWFLY IN WISCONSIN

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The European sawfly, Neodiprion sertifer (Geoffroy), was introduced into the United States in 1925. The first observation of this insect in Wisconsin was made in 1972. The sawfly can now be found in 11 counties, including Dane County where I live. The favored hosts include several species of pine: Scotch, red, jack, mugho and Austrian. Some other species may also be attacked.

The sawfly larvae hatch from eggs which the females deposit. When the female lays her eggs she opens a pine needle with her sharp, saw-like ovipositor (egg laying organ) and deposits 6-8 eggs in 10-12 needle clusters. In the spring the larvae emerge.

Larvae eat only those needles from previous years. The larvae will be gone before the current years' needles appear. Young larvae can't eat the entire needle (they leave the needles looking like curly hairs), but the older ones can. The larvae generally do not kill the tree. Instead, they slow down tree growth after many years of attack. Also, the sawflies make trees more susceptible to attack by diseases and other insects.

Birds, rodents and some insects eat the sawfly larvae and the pupal cocoons. However, these do not control the larvae very well. There is one natural enemy that has proven quite effective though. It is a small parasitic wasp that attacks only sawfly larvae and cocoons, and doesn't harm other creatures. The larvae are also susceptible to a special insect virus (which may sometimes be spread by the wasps). When the larvae die from this disease they turn brown and hang down from a branch. These infected larvae turn into little brown sacks full of the virus. The sacks break open and the virus is spread to other larvae, even in future seasons. Once a colony becomes infected, most individuals die.

It has been discovered that you can help spread this sawfly virus by grinding up infected larvae and adding water. You can then apply this solution directly to trees infested with sawflies, or you can apply it to the wasp pararsites and they will spread the disease. This solution to the sawfly problem is, I think, a good example of how man can control pests by natural means.

(I got the information for this article by interviewing David J. Hall, a forest entomologist with the Forest Pest Control Unit of the Wisconsin Department of Natural resources.)

ANATOMY OF A GRASSHOPPER

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EXTERNAL ANATOMY. Grasshoppers, like all insects, have three separate body parts: the head, thorax and abdomen.

The head bears a pair of antennae, which are sensitive to odors. Therefore a grasshopper smells with its antennae. Also located on the head are two types of eyes. One kind are the compound eyes and the other are the ocelli, or simple eyes. The head also has the mouthparts.

The thorax, or midsection, of a grasshopper is also divided into three segments. There is one pair of legs attached to each of these three segments. In the grasshopper the legs are used for walking, jumping and other functions. Sometimes the front pair are used to help during eating, and the hind pair are used for jumping. The legs have little spines and claws on them to help the grasshoppers hang on to leaves and other slippery surfaces. Wings are attached to the last two segments of the thorax. The first pair of wings are thickened, leathery and protective. The second pair are thin and membranous and used for flying.

The rear part of the grasshoppers body, the abdomen, is also many segmented. The first segment bears a tympanum, the organ for hearing. There are also tiny circular openings known as spiracles located on each abdominal segment. These are the openings of the breathing system and they lead to special breathing tubes or trachea. The hind segments of the abdomen are specialized for reproduction. In the male the tip of the abdomen is blunt and rounded; in the female it ends in a long, slender egg-laying structure called an ovipositor.

INTERNAL ANATOMY: Digestive System. Food enters the mouth and is mixed with digestive enzymes from the salivary glands. It then passes down a tube called the esophagus to a thin-walled storage structure called the crop. Food then travels to a thick-walled gizzard where their food is ground into smaller pieces. These smaller pieces of food then pass into the stomach where digestion actually takes place. Digestion involves the use of special enzymes to chemically break down the food so that it can be absorbed by the walls of the stomach. Any waste products that could not be digested are passed into the intestine. Virtually all of the water is removed and the solid waste is eliminated from the body through the anal opening.

Respiratory System. This system consists of a network of air tubes or trachea that lead to air sacs. Air enters the trachea through the spiracles.

Circulatory System. Grasshoppers have an open circulatory system and the "blood" does not travel within closed tubes, and instead flows through the body cavity. The blood carries nutrients and picks up wastes, but it does not carry oxygen. The only structure of the circulatory system is a tubular dorsal heart and aorta.

Nervous System. The grasshopper has a brain located in the head and a nerve cord that runs the length of the body near the belly side.

Reproductive System. Male grasshoppers have testes and female grasshoppers have ovaries, and they are located above the stomach and intestines. Both male and female reproductive organs lead to the outside through genital openings.

"ANT"-ICS: SOCIAL STRUCTURE WITHIN AN ANT COLONY

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Think about a society with half a million members. It is a monarchy, ruled by a queen. Most of the population is workers who do such jobs as collecting food, caring for young, herding domesticated animals, and building cities. There are also soldiers that defend the society. The members of the society cooperate to build complex structures, to gather food efficiently, to nurse their infants and to bury their dead.

You might think that anthropologists would enjoy studying a society like this. But you would be wrong. An entomologist is the specialist who would study this type of society - because it is a colony of ants.

People have been fascinated by ants for a long time. King Solomon, in the Bible, advised people to "go to the ant, thou sluggard; consider her ways and be wise...". Benjamin Franklin did a series of experiments with ants to learn how they communicated. St. Augustine, who lived during the time of the Roman Empire, commented, "We admire the works of the tiny ants more than the bulky forms of whales." More than any other insect, ants have captured the attention and imagination of people all over the world.

The Structure of Ant Society. Anywhere you go, you are likely to find ants. They live everywhere except in the oceans and at the North and South Poles. Wherever they are found, ants always live in colonies. The size of the ant colony may range from less than a dozen ants to more than a million.

All ant colonies are headed by a queen. Her main function is to lay eggs, and she can lay as many as twenty million of them during her lifetime. A queen ant is much larger than her workers. She has a huge abdomen and an arched thorax. She is the only female born with wings.

Most of the members of an ant colony are workers. All workers are sexually immature females who are much smaller than the queen. Workers may build the tunnels, gather food, nurse larvae and pupae, feed the queen, "milk" aphids, tend the food supplies, defend the colony, remove dead members -- everything that needs to be done except laying eggs.

There are not very many males in an ant colony. The male ant has only one purpose: to mate with the queen so that she can reproduce. Male ants die after they mate.

Some ant colonies have soldiers. They are a special caste of workers, which grow to be almost as big as the queen. Their heads are especially enormous (at least from the ant point of view).

A Colony is Born. The queen and several males soar through the air on a mating flight. One of the males mates with the queen and then he dies. The queen lands alone and scrapes off her wings by rubbing against a rock. She digs a hole or finds another nesting place. There she lays her eggs. She will stay in this hole for the next several months, until her eggs develop into adult ants.

During this time the queen uses her powerful wing muscles for nourishment. The muscles disappear slowly; the fibers shrink, releasing substances used to nourish the queen. When the eggs hatch into larvae, that will serve as their nourishment too. The queen gives the most

nourishment to the biggest larva, so that it will develop faster and be able to give her some help with the remaining larvae and pupae.

The eggs hatch into whitish-colored, worm-like larvae. The larvae grow into pupae. Some varities of ants spin cocoons at the pupal stage, but others do not. Eventually the full grown ant slips out of its pupa.

The first adult ants to develop in a new colony are smaller than those that come later and only live a few weeks. They take over the job of feeding and caring for the larvae and pupae, so the queen can concentrate on laying more eggs. As more and more ants become adults, they take on more jobs. Some may develop into "honey-pot" ants, ants that never leave the nest and whose function is for food storage. They have elastic abdomens which are filled with nectar that is gathered by other workers. Other ants are nursemaids, who watch, feed, and/or guard eggs, larvae and pupae. In some colonies there are "cowboy" ants, who "milk" the aphids that provide the colony with sugar. Some colonies have soldiers, large-headed worker ants who guard the nest. There are even slave ants in some colonies, captured by more aggressive ants to work in their nests. Most ants, however, spend most of their time gathering food.

How Ants Communicate. Ants would not be able to create and maintain their complex societies if they could not communicate with each other. Many people have tried to learn exactly how they do this. Here are some of their theories.

Some scientists believe ants communicate mostly by smell. Ants can secrete odors, called pheromones, from glands in their abdomens. Other ants then pick up the smell through their antennae. Some ants have many pheromones, while others only have a few. Each pheromone has a different smell, but they all come from the same gland. The ant secretes the odor by pressing its abdomen to the ground, leaving the smell behind. There are almost 10,000 different kinds of ants, and each has its own pheromones. Ants respond to the pheromones from their own nest. Ants use their pheromones to lay a trail to a food source, to warn other ants of danger, to attract a mate, and to communicate about starting a new nest. A dead ant has a distinctive pheromone which tells the others that it should be removed from the nest and taken to a burial pile. One scientist figured how to put that smell on a living ant. Its fellow workers carried it off to the burial pile, and when it found its way back to the nest they took him away again and again!

Some scientists also believe that ants communicate through body motion. If an ant finds some food, it will let the other ants know by touching them with its feelers and its front legs. Some ants move around frantically in a kind of dance if their colony is in danger.

Trails and Orientation. Another skill ants need in order to maintain their complex society is the ability to find their way back to the nest after they have been away looking for food. One way they do this is by light orientation. Ants can process the rays of the sun and orient themselves by it. They can distinguish between polarized and ordinary light, so they do not become confused when the sun moves from place to place in the sky. Scientists have experimented with ways to trick ants, such as covering them with a box so they don't know the position of the sun, moving or changing landmarks, or putting things in their way. But the ants almost always find their way home. Some ants also have the ability to recognize landmarks.

Ants also orient themselves by making fine distinctions of gravity, enabling them to determine how steep a path is.

Another way that ants orient themselves is by making odor trails. By pressing the tip of the abdomen to the ground, an ant secretes a pheromone that tells other ants which way to go. This is the most important orientation sense, because it is the only one that ants can use underground, and it is the orientation means that can be used by blind ants. When some researchers cut the antennae off of ants, the ants could no longer smell and they were unable to find their way back to the nest.

The Physical Structure of Ants and Its Relation to Social Structure. The physical structure of ants has evolved to make it possible for ants to live in complex societies.

Ants are unusual because they have a "social stomach" - a second stomach which is not used at all for an ant's own digestion, but which is designed to help the ant share its food with other ants. The food contained in this "social stomach" is digested and then regurgitated for other ants, the queen, and larvae.

An ant's antennae are important for social communication because that is where the ant's organs for smell are located. Some ants may communicate through sound. Noise-making ants have rough edges on their pedicels which they can rub on the sharp ridges of the second segment of the pedicel.

Finally, and most importantly, ants have the special pheromone glands in their abdomens, near the tail end of their bodies, which secrete the pheromones that are so important in communication and orientation. Some scientists believe the pheromones also tell the worker ants which jobs they should do.

Ants have lived on the earth for over a hundred-million years. They have outlasted the dinosaurs, woolly mammoths, and saber-tooth tigers. Some scientists belive ants will survive anything except for another ice age or the explosion of the sun. Throughout recorded history, human writers and thinkers have been amazed at their complex way of life. More than a hundred years ago, a scientist named John Lubbock concluded, "When we consider the habits of ants, their social organization, their large communities, and elaborate habitations; their roadways, their possession of domestic animals, and even in some cases, of slaves, it must be admitted that they have a fair claim to rank next to man in the scale of intellegence."

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THE CHOICE OF THE FRUIT FLY

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I experimented with fruit flies to see if I could find whether they preferred bananas over apples, or vice versa, as a food choice.

I began my experiment by setting up three one liter plastic soft drink bottles which were interconnected by plastic tubing. In the lid of one bottle I placed a slice of apple and in the lid of another I placed a slice of banana. I cut a "door" in the third bottle and left the entire apparatus next to a bowl of fruit consisting of apples, oranges and bananas.

Throughout the course of my experiment I observed very large numbers of fruit fly larvae and pupae in the liter bottle containing the banana. I also was able to observe large numbers of fruit fly adults flying around the bottle containing the banana. These observations have lead me to the conclusion that the fruit flies had a definite preference for banana over apple as a food source, both because of the larger number of adults attracted to the banana and the evidence of fruit fly reproduction in the banana.

During the course of my experiment I noticed that the banana began to ferment and it gave off an odor much sooner than the apple. I believe that the fermenting banana could have produced a stronger aroma and thus attracted more fruit flies. This would be a good subject for a future experiment to determine if fruit flies are attracted to a specific type of fruit or the odor of fermentation of all fruits.

ADDITIONS TO THE LIST OF CARABIDAE AND CICINDELINAE (COLEOPTERA) OF THE BEAVER ISLANDS, CHARLEVOIX CO., MICHIGAN (USA)

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Two years ago I published a list of ground beetles (Carabidae) and tiger beetles (Cicindelinae) known from the Beaver Islands of Michigan. The article (Dunn, 1985) contained a description of the islands in the Beaver Island archipeligo, as well as a list of the 155 species of beetles collected from 1919 to 1984.

In 1986 I had a third opportunity to stay on Beaver Island and was able to follow up on the collecting I had done in 1983 and 1984. I stayed at the south end of the island, and for the most part collected in many of the same areas and habitats as on the two previous visits. Despite collecting in these same areas I was still able to collect at least 7 species never before taken on the island.

One big change in the island's environment since the previous visit is worth mentioning. The island had literally "shrunk"! The record high water levels of the Great Lakes had caused considerable beach erosion and had indeed left less of the island above the waterline.

I think these new records are significant enough to warrant publication. They are as follows:

(1) Cicindela macra LeConte - Iron Ore Bay beach, 23-vii-1986, 1 male & 1 female. [New County record; northern-most record of this species for Michigan, and probably North America.] This small population at the south end of the island must have become established in 1985 or 1986. The nearest known population is located on North Manitou Island (Leelanau Co.), 36 miles to the southwest. It would be interesting to search North and South Fox Islands, which are located about midway between the Manitou and Beaver Islands, to see if C. macra is established there.

(2) Elaphropus incurvus Say - Iron Ore Bay beach, 25-vii-1986, under beach drift. This beetle was apparantly collected by Hatch (1924) but not included in my 1985 list (Dunn, 1985).

(3) Bembidion tetracolum Say - Iron Ore Bay beach, 22-vii-1986 and 25-vii-1986 (4), under beach drift.

(4) Pterostichus patruelis Dejean - Beaver Island lighthouse, 21/22-vii-1986, pitfall trap in beech-maple forest.[New County record.]

(5) Agonum superioris Lindroth - Beaver Island lighthouse, 23/24-vii-1986, pitfall trap in beech-maple forest.

(6) Selenophorus opalinus LeConte - Iron Ore Bay beach, 25-vii-1986, under beach drift. [New County record.]

(7) Discoderus parallelus Haldeman - Iron Ore Bay beach, 25-vii-1986, under beach drift. [New County record; northern-most Michigan record.]

(8) Tetragonoderus fasciatus Haldeman - Appleby Point beach, 23-vii-1986, under beach drift. [New County record; northern-most Michigan record.]

This brings the total number of species collected on the Beaver Islands to 164 (in 40 genera). There may still be a few unrecorded species, but due to the small size of the islands and the limited number of unique habitats available to these beetles, I suspect the list is about as complete as it will get

THE BLACKISH FOUNDER OF A CITY: POLISTES FUSCATUS*

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New cities are founded each spring by the Blackish Ones. These are not cities of tall buildings and paved streets, and the Blackish Ones do not keep regular 9 to 5 business hours. Instead, these cities are made of tubes of paper, constructed side by side by the Blackish Ones. The cities are the nests of Polistes fuscatus, whose name is derived from both Greek and Latin and means "the blackish founder of a city".

These paper wasps are common summer sights in much of the United States. Although they might buzz about your face or land on your arm as you play or picnic or garden, they mean you no harm. Away from their nest, the paper wasps are not aggressive and will not sting unless severely provoked. Active only when the temperature warms to 60 degrees F or above, wasps search for nectar to eat and caterpillars to feed their larvae, and wood (nesting materials) and water. They are quickly attracted to droplets of water, especially on a bright, sunny day, and if you wish to examine them more closely, the wasps can be easily lured to your finger tip with a drop of honey. They are not usually attracted to picnic lunches, as are the pesty yellowjackets. The paper wasps are extremely tolerant of humans and of minor disurbances, and for this reason are easily and relatively safe to study. The open faced nests affords the observer an excellent view of the entire nest and its inhabitants. Scientists frequently study Polistes species as examples of animal behavior. They are easily reared in the laboratory.

GENERAL DESCRIPTION. The various paper wasps (most Polistes are tropical) range in size from 1/2 to one inch (13-25mm). They have long hind legs that dangle gracefully below a pointed abdomen (fig. 1). Closer examination will reveal that their head and body are mostly brownish-black. The thorax may have yellow and/or red markings. One or two, but maybe even three or four, of the abdominal segments are edged in yellow, and very often red spots can be seen on the sides of the abdomen. A short, one-segmented petiole (stem) joins the abdomen to the thorax (fig. 2). The wings are translucent amber-violet in color and fold back lengthwise like a folded fan against the thorax and abdomen when the wasp rests. If the wasp has just landed momentarily to forage, groom or work the wings are held in a perfect V formation. The red or blackish-faced females have straight antennae; the yellow-faced males have hooked antennae (fig. 3).

All Polistes have a smooth sting and can sting repeatedly, as compared to the honey bee workers that have a barbed sting and die after stinging. The sting is used to serve as an ovipositor (egg layer) in Polistes ancestors, but today the sting is used only as a defensive weapon. The sting is absent in the male. The fluid from the sting contains, among other chemicals, histamines and amino acids. Many humans are severely allergic to the stings of bees and wasps.

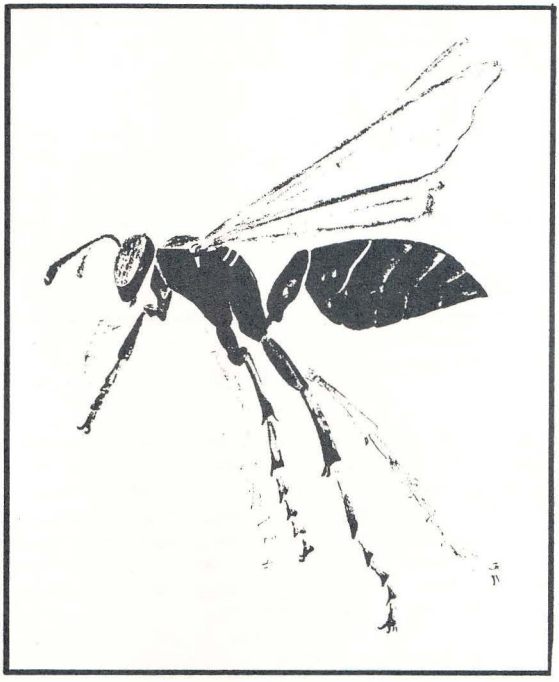

Figure 1. The paper wasp Polistes fuscatus, side view.

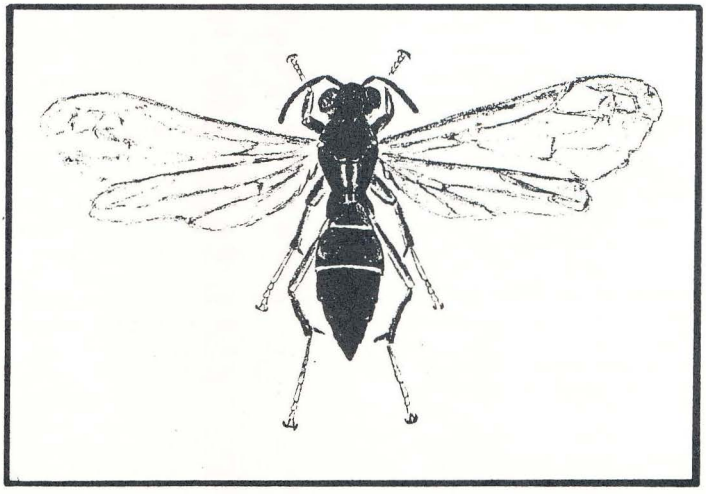

Figure 2. Typical markings of Polistes fuscatus. In this illustration the lighter gray of head, thorax and abdomen in actually reddish-brown, and the white markings on the abdomen are yellow.

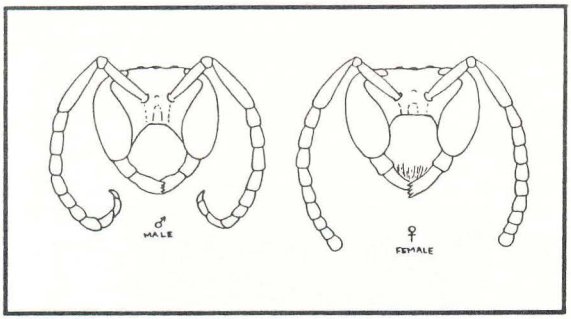

Figure 3. A comparison of the heads and antennae of male (left) and female (right) Polistes fuscatus.

THE SENSES. The paper wasps can sense substrate vibrations (through objects on which they are standing) and have excellent vision. Two large compound eyes cover a large portion of the sides of the head. Scientists believe that wasps, as well as ants and bees, cannot hear airborne sounds.

The sense of smell is very well developed, and experiments have indicated that it is by sense of smell that wasps recognize each other and their nest and surroundings. By odor Polistes can recognize their kin. Even when they are separated (in experiments) for long periods of time they are able to recognize each other after being re-united. In the spring, the colony foundresses are able to recognize their sisters, and together these siblings start their colonies. The wasps can, by odor, sense wasps that are not members of their colony. The sense of smell is probably the most important sense in the world of the wasp.

NUTRITION. Adult paper wasps feed upon nectar and juices from crushed and rotten fruits, and upon the honeydew produced by aphids. They also eat a fluid which is emitted from the mouths of their own larvae. The larvae are fed pre-chewed insects by the adult workers. The exchange of nutrition between adults and larvae is called trophallaxis.

POLISTES FUSCATUS. The text of this article deals specifically with Polistes fuscatus, the northern paper wasp, which can be found north to British Columbia - about 52 degrees N latitude - and south to Honduras. P. fuscatus is absent from South America. It ranges in size from 5/8 to 7/8 inch in length.

Remarks concerning dates of nest initiation and colony or individual life cycle refer to those colonies in southeastern Michigan (USA), and these dates will vary depending upon length of daylight hours and temperatures in any given region. (Note: P. fuscatus is the only species of Polistes in Michigan.)

THE NEST. The nest of Polistes, figure 4, is commonly seen under eaves and overhanging parts of buildings, in attics, barns and sheds, and in fields under flat rocks or sometimes in bushes. Its many hexagonal cells are formed of grayish-brown paper made from materials the wasps gather from old fences, unpainted boards, dry weeds and grass stems, and even from newspapers or paper bags. Paper wasps have not been observed using material from an old nest.

The flat nest hangs from a pedicel, or narrow stem, which apparently protects the colony, making defense of the nest easier, for the only access to the nest by walking predators is across the bridge-like pedicel. Worker wasps are often seen licking the top of the nest and the pedicel and a hard, glossy coating can be seen on the nest top and pedicel. This coating that the wasps apply is a chemical ant repellant, and it may also strengthen the nest and pedicel.

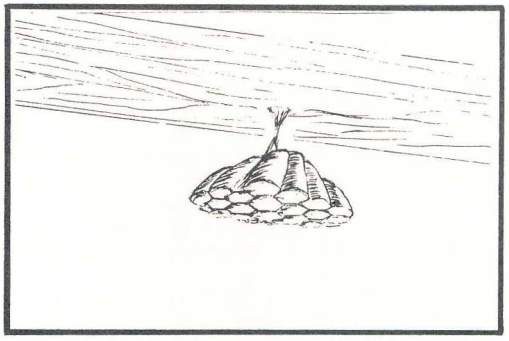

Figure 4. A young nest of Polistes fuscatus.

Nest initiation begins in mid-May (in Michigan) and is affected by the length of daylight hours (photoperiod) as well as the temperature. During early warm spells the wasps might be seen sunning, looking for nectar and for a nest site. They will cluster together, but this clustering does not indicate the site of a nest. Soon, the wasps separate and go to the natal site (place where they were born and spent the previous season) apparently using visual orientation cues to guide them. These cues might include roofs, shutters, windows and gutters, the sizes and shapes of which visually guide them back to the natal site. At any time during the warm months, Polistes might be seen hovering over an orientation cue before flying onto the nest.

The new nest is usually constructed near the natal site. The wasp that initiates the nest building usually becomes the queen. Usually some of her siblings (her "sisters"/nestmates from the previous season) join her and help in the construction of the nest and care of the colony. At this time they form foundress associations in which they sort themselves into ranks. They have violent battles that sometimes result in death. The winner of the battle becomes the queen; the losers become subordinate and act as workers.

After a nest site has been chosen, construction begins. In removing the wood fibers from a wood source - an old fence perhaps - the wasp walks slowly backward in a straight line and loosens a continuous strip of wood with its mandibles (jaws). A tick - tick noise can be heard while the wasp does this. With its mouth and forelegs, the wasp rolls the pulp into a ball. This session may last two or three minutes, after which the wasp flies abruptly away to the nest.

At the nest, she inspects the cells, strokes them with her antennae, and then applies the pulp, usually to a low area. With her mandibles, she chews the pulp and applies it to the nest and shapes the cell. Her antennae are used at this time to feel the surrounding cells, and by thus can determine the shape and size of the cell she is constructing.

Most often, a wasp will return to the nest with a load of pulp and will divide it with another wasp. While one wasp adds pulp to the nest, the other wasps of similar rank stand aside and permit her to work. Scientists feel that perhaps the wasps "odor mark" the nest by rubbing a secretion from the abdomen over the comb and pedicel during construction. The wasps can definitely recognize their own nest (with or without brood) and probably use odors to do so.

THE COLONY LIFE BEGINS. Nest building and egg laying begins in May and the first brood emerges from cells in June. The time of development from egg to adult is almost 50 days; the eggs stage is 13 days, the larval stage is about 15 days (usually shorter at higher temperatures), and the pupal stage is about 22 days.

From May to September the "membership" of the colony changes. Adult wasps observed on the nest in late spring are the queen and her co-foundresses. The first wasps to emerge in June are female workers. They forage (bring food, water and pulp to the nest) and care for the nest. Toward the end of July males will emerge, as well as more female workers and also female non-workers.

The birth rate of the colony is at its peak from late July until late August. Colonies of Polistes fuscatus range in size from approximately 20 - 75 members. The size of a particular colony can be approximated by counting the number of empty cells in a vacated nest.

EGG LAYING. Usually the queen is the only egg layer, but during the first few weeks after construction begins, a co-foundress with well-developed ovaries (egg making organ in the abdomen) will often oviposit (lay eggs). The wasp with the most-developed ovaries will become the queen, and dominance ranks amongst wasps are in direct relationship with ovarian development. If other egg-laying wasps are present on the nest with the queen, the egg-laying wasps eat each others eggs, then lay their own eggs in the empty cells. (This egg eating is called oophagy.) The more developed wasp can lay more eggs in a given time period than the wasp with lesser developed ovaries, keeping the cells filled with her own eggs. Scientists have discovered that the presence of empty cells stimulate wasps to lay eggs (and also that the urge to oviposit stimulates cell construction). Therefore, the queen can usually take away the stimulus - empty cells - for egg laying from the lesser developed wasps. The ovaries of the subordinate wasp regress after a period of association with a dominant wasp, and soon subordinates do not oviposit.

However, if the queen were to disappear from the nest, a power struggle amongst the high-ranking females would occur until one would become most dominant. This wasp would then resume egg laying and would become the new queen.

FROM EGG TO ADULT. One small, moist white egg is laid in each paper cell and 13 days after the egg is laid, it will appear to develop a mouth and will begin to move. It thereby enters into the larval stage. The helpless larva, which looks like a tiny white sac with a mouth on one end, is totally dependent upon the adult workers and remains in the nest cell. The larvae are fed pre-chewed insects by the adults. The adult wasp will tap the larval cell with her head at feeding time, and the larva will stretch out to the end of the cell to receive its food.

Nutrition during the larval stage is important to the development of the wasp. The well-fed larvae become larger, and most importantly, in the case of those female workers born in the late summer, have more developed ovaries than those larvae which are not fed sufficiently. Scientists have observed that those larvae in the center cells of the nest are the ones which receive more food from the adults.

Fifteen days after it enters the larval stage, the larva spins a white silken cocoon, sealing itself into the cell, and enters the pupal stage. The cell is capped by the silk. The pupae are inactive and helpless. After 22 days, the wasp will emerge from the pupal cell as an adult.

BEHAVIORAL OBSERVATIONS. To the observer, different kinds of wasp behavior can be seen: the dominance of the queen and subsequent subordination of the co-foundresses, the dominance/subordinance behavior of wasps of unequal rank and fighting amongst those of equal rank, nest vibration, the behavioral differences between workers and non-workers, the clustering of wasps together, drop making, the difference in behavior amongst the male members that are on the nest and those males that are off the nest, mating behavior and colony abortion.

THE QUEEN. The queen, which is usually the nest initiator and the dominant female with the most-developed ovaries, spends more time on the nest than do the workers, and spends more of her time active than other colony members. She initiates interactions with the other wasps by antennating, bumping, biting, grappling, and chasing them. Her activity promotes activity in the workers, and she regulates colony activity. She can be seen inspecting the nest, walking, chewing pulp or prey and building the nest, rubbing her abdomen on the nest and pedicel, grooming, fanning the nest and laying eggs. Her active and dominant behavior make her distinguishable from the workers. It is difficult to tell the difference between the the workers by appearance alone, but the queen is somewhat larger.

The queen acts agressively toward inactive workers, but is tolerant toward those that are active. Scientists believe that the level of worker activity is associated with the activity of the queen rather than the queen's interactions with the workers - that she sets an example for them rather than urging them to work.

DOMINANT/SUBORDINATE BEHAVIOR. When wasps of different ranks meet each other, dominant and subordinate behavior can be seen. A dominant wasp will move toward the subordinate wasp with head and antennae held high. The dominant wasp will sit on the face of the nest, whereas the subordinate will sit on the top or off the nest. The dominant wasp may bite and antennate the subordinate. The subordinate will retreat and stay away from the dominant wasp. The head and antennae are held low by the subordinate wasp.

When wasps of equal rank confront each other, fighting may occur, which involves clashing, biting and even stinging. Frequently, one will fall from the nest. This type of behavior is very common during nest initiation, when the foundresses are fighting for dominance - for one to become the queen.

NEST VIBRATING. On the nest, Polistes may be observed - and heard - vibrating the nest. In recent studies of Polistes metricus these movements were analyzed, and two movements were found to be of particular interest to scientists.

Abdominal wagging, a slow side-to-side wagging of the abdomen against the face of the nest, produces a faint rustling sound. This is performed by the female as she walks across the face of the nest either before or after inspecting the cells.

In pre-emergence colonies (before any of the wasps emerge from the pupal cells as adults) abdominal wagging is performed almost exclusively by the queen. The other foundresses do not respond to abdominal wagging. The queen will wag her abdomen if the other foundresses are present on the nest or not. In the pre-emergence colonies, abdominal wagging is first conducted when the first brood contains larvae which have reached a certain stage of maturity (third instar larvae).

In post-emergence colonies (after the first wasps emerges from its pupal cell as an adult) the abdominal wagging is performed more often by the queen but also by the workers. In these colonies the performance of abdominal wagging is significantly correlated with the number of third larval instars present in the colony and the frequency of prey trips by the workers.

Lateral vibrations consist of a female rapidly shaking her entire body in a horizontal plane against the top of the nest, while stationary. This produces a short, loud burst of sound.

On early pre-emergence nests this behavior is exhibited by both the queen and subordinates, and is executed much more frequently in the presence of other foundresses rather than when the wasp is alone. The queens and the subordinates show distinct responses to lateral vibrations. When the queen vibrates, subordinates retreat from the queen or leave the nest. When subordinates perform a lateral vibration the queen either does not respond at all or she becomes agitated and often chases the subordinate vibrating wasp from the nest. Sometimes the subordinate wasp executes a lateral vibration then immediately leaves the nest.

In post-emergence colonies the queen performs roughly five times as many lateral vibrations as individual workers. The frequency of lateral vibrations are positively correlated to the number of larvae, of workers, and of female workers on the nest.

Scientists suggest that abdominal wagging functions in adult-larval interactions and that lateral vibrations are an adult communication.

These studies of Polistes metricus may help us understand the same body movements in P. fuscatus.

THE WORKERS AND THE NON-WORKERS. Those female members of the colony that are workers can be observed returning from flights with foraged loads of wood, water and prey. Other working and non-working wasps on the nest will solicit (beg and receive) foraged materials from the returning workers, and these loads might even be re-divided amongst others. The solicitor antennates the forager, which regurgitates (brings up from the stomach) liquids, or they stand at opposite ends of a solid load and chew it until it is divided.

The workers will sit dispersed across the face of the nest and are involved in building activities.

Workers are aggressive toward intruders, to parasites, or to wasps that do not reside in the colony. The resident workers will meet the non-resident intruder with legs waving in the air, buzzing and attacking.

The female non-workers are born in July. They are non-aggressive. They retreat from intruders and return from flights without building materials or food. They sit clustered together on the nest.

These non-workers are the wasps that will mate in the fall and overwinter (hibernate). In the spring, some will be queens and others will join the queens in foundress associations. The non-worker females are also called potential queens or gynes. Because they do not forage or work on the nest, they spend less energy and have large fat stores to get them through the winter, they are less prone to injury and are better nourished and larger in size. These are important factors during hibernation.

CLUSTERING. Polistes can be seen in clusters, where they will rest in contact with each other. Clustering will occur amongst subordinates which stand still when touched, amongst chilled members on a cool day or amongst specimens that have been refrigerated, or around dead wasps. Female non-workers habitually form clusters.

In the cooler days of autumn when the workers are on the face of the nest, the gynes (non-worker feamles) and the males can be found clustered on the top of the nest. When warmed they will leave the cluster, return to the nest to solicit, then rejoin the off-nest clusters.

In mid-August, on warm days, clusters of mostly males occur away from the nest, often in cracks and abandoned old nests, more frequently in dark places.

DROP MAKING. In the autumn the male and female wasps can be seen with a drop of liquid on the mouth area. The wasp slowly draws in the fluid with a chewing motion, shifts position, then lets out from its mouth another drop by pumping the abdomen. This is done repeatedly, every few minutes. Other wasps do not bother the drop, but if the wasp is bumped, it will suck the drop back into its mouth. Scientists have found that the droplets are of a sweet substance and they feel that the wasps are trying to get the water to evaporate, leaving behind a higher concentration of the nutritious sugars.

MALES ON THE NEST. The males do not forage. They solicit food and water, but not pulp, from returning foragers. In August there are many male solicitors on the nest. This decreases the amount of food given to the larvae at this time. Males almost never contribute to colony work.

The males sit low and immobile on the nest top or near the edge of the nest. They often fan their wings, collect fluid from the mouths of larvae, and attempt to mate, but are not successful in doing so. They are both attacked and chased by the female workers.

MALES OFF THE NEST AND MATING. Males that have left the nest are aggressive and sexually responsive. They sit at the site where the potential queen will hibernate for the winter (the hibernaculum) which is near cracks in walls, under shingles, under tree bark, or other such confined places.

Mating does not occur on the nest. Mating occurs in late summer or early fall, on sunny days close to buildings, sometimes near the hibernaculum. The raised abdomen of the female attracts the male. During mating, her sting is pushed out (extruded) and bent to the side. The female reacts aggressively and struggles violently. The male will stroke

her with his antennae and grasp her straight antennae with his curved antennal tips. After mating, he will return to his place near the hibernaculum. The sperm are kept within a small organ (the spermathecum) in the abdomen of the female and will be used as she lays eggs the next spring and summer.

COLONY ABORTION. Near the end of the season some species of paper wasps destroy their colony. The larvae and pupae are pulled from their cells and are divided amongst the adults, fed to some remaining larvae, or dropped from the nest. Polistes fuscatus does not participate in this abortive behavior on a large scale.

THE DEATH OF THE COLONY. Cold temperatures bring death to the paper wasp colony. The queen, the workers and the males die. The only wasps to survive are the mated females which will overwinter and emerge from the hibernaculum in the first warm days of spring. A new colony - a new life cycle - will then begin. A new city will be founded, will thrive and will die. City after city, year after year, the Blackish Ones live on.

STUDYING THE SOCIAL INSECTS.

Polistes, like some sweat bees and all bumble bees are primitively social animals. They are in the middle of a social scale of insects between the solitary insects and the highly social insects (ants, termites and honey bees). Scientists are interested in studying primitively social insects since the highly social insects probably had passed through the primitive stage as their social way of life evolved. Polistes fuscatus is the most extensively studied social wasp.

ADDITIONAL INFORMATION

More specific and scientific information concerning Polistes fuscatus may be found in Miscellaneous Publication #140, "The Social Biology of Polistine Wasps" by Mary Jane West-Eberhard; it is available from the Museum of Zoology, University of Michigan, Ann Arbor, MI 48104 USA. It is this publication which proved most helpful to me in understanding the paper wasps.

ACKNOWLEDGEMENTS

I am grateful to Dr. George Gamboa of Oakland University, Rochester, Michigan (USA) for referring me to the West-Eberhard paper, for answering so many of my questions, and for proof-reading my paper. I am also very grateful to Larry G. Bezark of Sacramento, California (USA) for sending to me supplemental information, and also for proof-reading the paper. My thanks go also to Mark O'Brien, Museum of Zoology, University of Michigan, Ann Arbor, Michigan (USA) who also sent information for my study.

(Editor's Note: The author, Mrs. Kersey, is an amateur naturalist, with her main interests in wildflowers, paper wasps and various species of spiders and snakes. She is not a professional scientist and does not claim to be an expert in any given field of study. She has presented this paper to Y.E.S. so as to share her studies with young and amateur entomologists so that they might be inspired to expand their horizons.)

ANGELA'S ANT PROJECT

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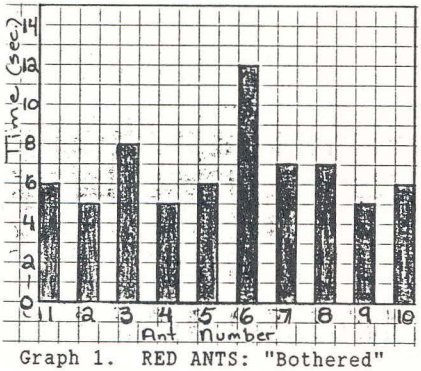
I decided to do two experiments to see how both red and black ants would respond to being disturbed, and find out how long it takes them to resume their activity.

The first experiment consisted of placing an ant on a leaf and then turning the ant around to face in another direction. I then kept track of the time it took the ant to resume travelling in the original direction.

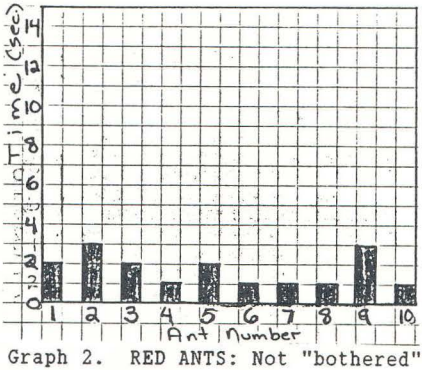
In the second experiment, which I called "bothering the ant", I turned the ants around, trapped them with my hands and turned them over. As with the first experiment, I kept track of the time required for the ants to resume traveling in the original direction.

The results of my second experiment can be found in graphs 1 - 4. My data suggests that the red ants require more time to become re-oriented after I "bothered" them. The black ants have shown that they are less prone to being disoriented, perhaps because of their larger size.

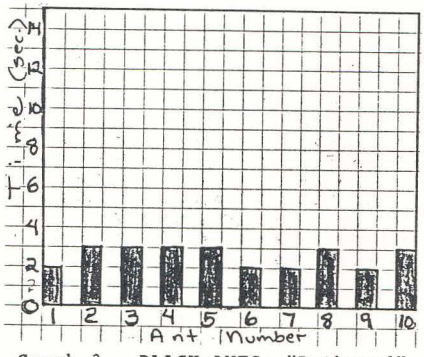
The results of my first experiment showed that both red and black ants continue on their way almost immediately when they are simply reversed in their direction of travel, and it is only when they are severely disoriented ("bothered") that the red ants perform poorly.



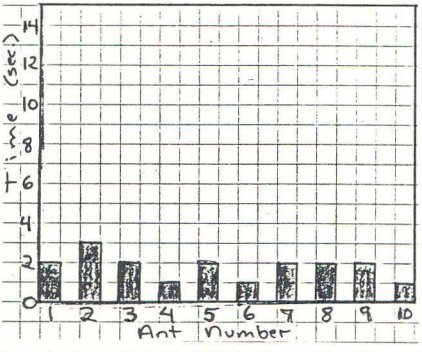
Graph 1. RED ANTS: "Bothered"



Graph 2. RED ANTS: Not "bothered"



Graph 3. BLACK ANTS: "Bothered"



Graph 4. BLACK ANTS: Not "bothered"

EUROPEAN EARWIGS

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I became interested in the European earwig when I saw an article in the newspaper. One morning I was reading through the headlines when I saw an article that looked very interesting. The headline read, "European Earwigs Invade Wisconsin Homes". Then I saw a picture of the earwig. It had a skinny, segmented body, and fierce looking pincers (called cerci). I wondered why these ugly looking creatures would invade my home state. Later, when I was asked to write a science report for school, I decided that researching the European earwig might make an interesting topic.

I first started by digging through our old newspapers trying to find the article, but after an hour with no luck I decided there must be a better way. So I called the local library and they were able to get a copy of the article for me. Still, I decided I needed more information, so I got the name of a local entomologist. I called him and asked for any information he might have on earwigs. A day later I received a package with about ten pages of information on earwigs! I proceeded to sort through and combine the useful information I found. My final step was to actually start writing. I decided that the things I most wanted to learn were this: (1) Are earwigs really as ferocious as they look? (2) What is their life cycle like? and (3) Why would they "invade" Wisconsin (USA)?

I think that in my studies I learned enough about earwigs to answer all of my questions. First, earwigs are not as ferocious as they look. However, they have been know to draw a little blood with their cerci if they are disturbed (handled). I also found out all about their life cycle (see table 1). Finally, I found out why the earwigs "invaded" Wisconsin. The mild winter of the previous season had enabled large numbers of earwigs to overwinter and so populations reached enormous numbers. In fact, the earwig was already present in Wisconsin, it just went through a population explosion.

Table 1. Life cycle of the European Earwig (summarized).

(1) Female lays eggs in underground chamber.
(2) Female exhibits maternal care of eggs (quite unusual in insects).
(3) The eggs hatch; the chamber remains closed.
(4) The chamber is opened.
(5) Food is brought to the young by the adults.
(6) Young remain in the chamber until their first molt.
(7) Mating takes place in the fall, in special chambers.
(8) Females lay two clutches of eggs.

I also learned a lot of things about earwigs that I didn't expect to learn. Earwigs are nocturnal insects and are often mistaken for roaches. They like to live under rocks and lumber where it is moist. The females will eat their young if they are disturbed during incubation (the stage in which the mother earwig cleans and protects her young nymphs and eggs).

A STUDY OF HOW ANTS FIND THEIR FOOD

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The purpose of my experiment was to find out which of the following senses attracted ants to their food: taste, sight, or smell.

It is well known that common garden ants feed on fruit, sap, nectar and foliage. Most of the ants are said to be fond of sweets. My hypothesis was that ants would be attracted to a solution of sugar water, and also to the color green (since the plants that ants feed on are usually green).

For my experiment I caught in my backyard three common garden ants (Hymenoptera: Formicidae). I then prepared four solutions: plain tap water, sugar solution #1 (one teaspoon sugar to one quart water), sugar solution #2 (one tablespoon sugar to one quart water, and sugar solution #3 (one cup sugar to one quart water). I placed 62.5 milligrams of each solution at the 12 o'clock, 3 o'clock, 6 o'clock and 9 o'clock positions on a flat dinner plate. I put the ants in the center of the plate and covered it with plastic wrap so that they could not escape and so I could observe them easily.

For the second part of the experiment I mixed 62.5 mg of sugar solution #3 (the sweetest) with blue, red, yellow and green food coloring (one drop each), and put them on a plate in the manner previously described.

For the third part of the experiment I put an apple core in the center of the plate with crums from a sweet cookie made with crushed oranges. I left the solutions in place. I again made my observations.

I observed the ants for twenty minutes under each of the three experimental conditions. In both the taste and sight (color) tests the ants reacted in the same way. They did not stop at any solution for more than one second, but they did look at each one. They stayed mostly at the edge of the plate trying to get out. When I put the apple core in, introducing a strong fruit smell, the ants went directly over to it. They made six contacts, for a total of 19 minutes and 22 seconds. When I put the strong orange-smelling cookie crumbs in, the ants ignored them. Even when they were off of the apple they would just walk right by the crumbs without stopping.

From this experiment I concluded that ants prefer the "real thing". They do not seem to choose their food by sweetness, color, or smell alone, but by familiarity with the object. What makes a food familiar could be the combination of sight, taste and smell. In future experiments it would be interesting to find out what would happens if I use a real orange against an apple core, or real fruit juices in place of sugar water.

FRUIT FLY GROWTH

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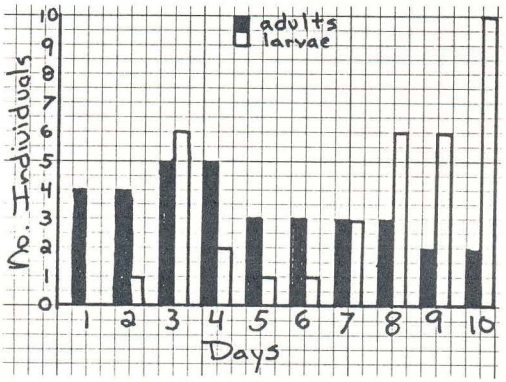
I was interested in knowing more about the growth of fruit flies, especially the fact that they could reproduce 24 hours after becoming adults. I wanted to observe how fruit flies reproduced, and so I set up a ten day experiment.

I left some grapes in my room and waited until flies surrounded it. Then I put the grapes and flies into a jar with a lid (fig. 1). Every 24 hours I would count and record the number of larvae and adult flies in the jar (graph 1).

The flies were not doing very well, and I couldn't figure out why. My science teacher reminded me that all living creatures need food and water, and I think my forgetting to provide water for the first six days had something to do with the death of the flies!



Graph 1: Numbers of fruit fly larvae and adults during my 10 day experiment.

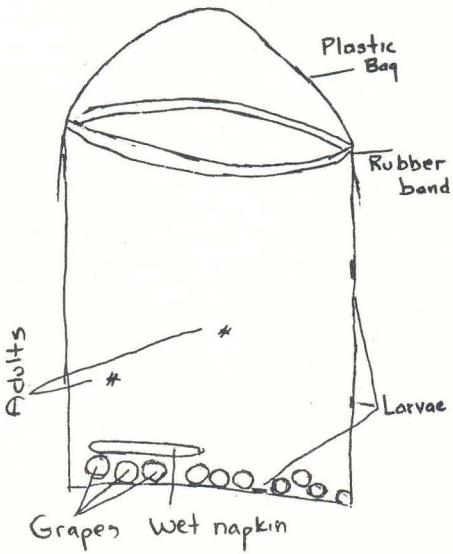


Figure 1: My experimental setup.

ANATOMY OF A HONEYBEE

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The honeybee's body, like all insects, is divided into three parts: the head, thorax and abdomen. The head includes most of the sensory structures, mouthparts and optical sensors. The sensory structures include the antennae, or feelers. The optical sensors, or compound eyes, are made up of several thousand individual lenses, each connected to the brain by an individual nerve fiber. The jaws, technically the mandibles, are also connected to the head.

The thorax, or mid-section, of the bee is where the wings and legs are attached. There are three pairs of legs and two pairs of wings connected to the thorax. The attachment of the legs and wings are very flexible and their movement is made by a complex system of thoracic muscles. On the rear legs are pollen baskets, and as the honeybee flies from flower to flower, pollen is collected. When the bee flies to other flowers the pollen in the basket rubs off and pollinates (fertilizes) the flowers.

At the rear of the abdomen there is a stinger and breeding organs. The bee's stinger is actually an ovipositor, the egg laying apparatus. If the bee is bothered or annoyed, it will thrust its' stinger into the victim causing severe pain. The stinger is not easily extracted and as the bee flies away the stinger remains with the victim. Unfortunately the bee suffers the loss of its body part and dies soon after.

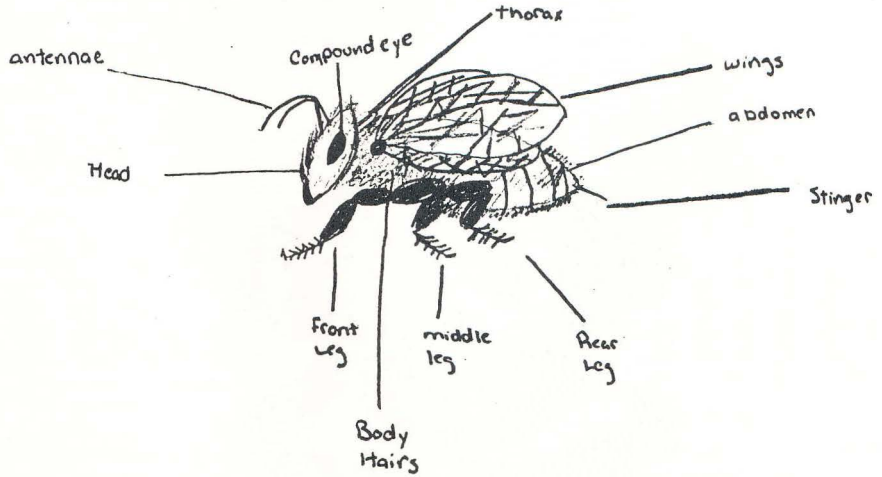

Figure 1. Diagram of the honeybee. Drawing by Michael Reddy.

PESTICIDES

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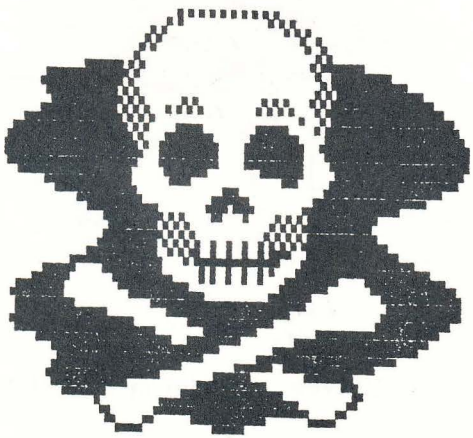
Pesticides are an important part of our lifestyles today, whether we know it or not, and without them we would lose a lot of our plants and food sources. Although they are very important, this doesn't mean all forms of the pesticides available today are entirely safe. In fact, the negative effects of pesticides have even led to dangerous consequences that do affect humans.

In 1968, eighteen years ago, statistics from the National Center for Health Statistics (U.S. Department of Health and Human Services) showed that 72 people in the United States died from accidental pesticide poisoning. As a percentage, this is 2.8% of the total deaths from accidental poisonings. In 1974, just twelve years ago, the percentage of deaths from posioning by pesticides dropped to 0.9%, a total of 35 people. In 1978 the percentage was 1.0%, or 31 people. The statistics also showed the categories for the substances most frequently ingested by children under the age of five. Insecticides showed up on the chart in 1972 at 2.2% of all incidents; the number of children in the United States that had ingested pesticides was 2306. Five years later, in 1977, the number rose to 2723 children (2.9%). Another year passed and the new statistic showed another 2.9%, or 2675 children.

With all the statistics showing a rising percentage and number of deaths, a question arises. How is our society and government handling what is happening? In other words, what are our laws and regulations concerning these effective, yet frequently dangerous, pest-controlling substances?



First of all, it is important to understand the hazards and dangers of pesticides. Poisonous liquids, or dry forms of these types, that are spread over infested areas may have unexpected and wide-spread effects. To narrow this down, we can divide these dangerous effects into two categories. One of these categoreies is what happens to the animals, including humans, that were not meant to be affected by the chemicals. Insects, some of which are useful the plants and crops, may be destroyed in the process. These insects may include ladybird beetles (ladybugs), bees and wasps. After the crop that has been exposed to the insecticides, a residue may be left which is dangerous to neighboring animals, and humans. The second category refers to the negative effects that happen to plants that have been sprayed with chemicals. The benefits of helping the plants to grow in a healthier environment will not help if the are no plants left, right? Destruction of crops, then, is another negative effect that pesticides may have on plants and the surrounding habitat.

Legislation varies in each country, but all laws have something in common that we should understand. All the laws that are made concerning pesticides are for the benefit of humans.

First of all, we should familiarize ourselves with the government agency that handles most of the laws and legal matters that apply to pesticides in the United States. This was best explained by George W. Ware in his book "Pesticides - Theory and Application".

> "The EPA (Environmental Protection Agency of the USA) was established on December 2, 1970, to develop, coordinate, and monitor federal policy regarding environmental problems such as air and water pollution, pesticide regulation, solid-waste management, and radiation and noise abatement. In the areas of pesticide registration, regulation and research, the EPA assumed most of its' duties from the Department of Agriculture, Department of Health, Education and Welfare, Department of the Interior, Atomic Energy Commission, Federal Radiation Council, and the Council for Environmental Quality. By consolidating the broad power for pesticide registration in one agency, the federal government hoped to provide efficient and effective regulation and enforcement policy."

The preceeding paragraph should have given you a pretty good idea of what EPA's job is. Now the question is, what are the laws and restrictions that the EPA has put out? Some of the laws for regulating pesticides can be easily guessed since they are based on common sense.

One which is very important, for instance, concerns restricted-use products. Pesticides are put into one of two categories: general use or restricted use. Before any new pest control chemical is admitted it must first be tested to assure that there is no real large risk involved. The criteria to judge which pesticides are restricted include danger to humans ("human hazards"), effects on aquatic organisms, birds and other non-target organisms, as well as any previous accident records that apply to the pesticide.

Certification of applicators ties right into restricted use pesticides, as only certified applicators have the legal right to purchase and apply these pesticides. All certified applicators are required to have special training. The training program includes skills and knowledge on application, safety and usage of pesticides. This training and testing is usually administered by a (state) agency that is tied to the EPA.

Product labelling is a very vital part of safe pesticide use, because labels say a lot. Most of what a label tells, though, is information on the safe use of the pesticide. The buyer or user is required by law to know the potential hazards. Warnings must be placed on the label in bold print. Usually these warning words (so-called "signal words") such as DANGER - POISON must be on the label, especially for those products that are highly toxic. The signal word WARNING is required for moderately toxic pesticides. For less toxic pesticides the signal word CAUTION must be on the label. All labels must bear the statement "KEEP OUT OF REACH OF CHILDREN".

Another common law regarding insecticides concerns safety for the agricultural worker, the man or woman that is exposed to the chemicals. Waiting intervals (safe re-entry) are specified on product labels so that workers will know when is is safe to go back into the fields to work.

There are many other laws concerning pesticides, but by now you have probably heard enough of the specific laws. Now then, in your opinion, do you think that all of the registered pesticides are safe? Not all pesticides are entirely safe, of course! Remember the DDT controversy in the USA a few years back? What about the accidental poisonings I mentioned?

So far I have been talking about the usage of pesticides on large areas of land. What about the use of aerosol insecticides that are around in just about every home? Grabbing a can of insecticide may very well control your ant problem, but what happens when you get that sticky fluid on your hands, or even worse, in your eyes? Most household insecticides are not highly toxic, but the effect they can have on a human being can still be very bad.

In the opinion of some people the existing pesticide laws in the USA are useful laws, but the way that the government and society carries them out is when problems arise. If the label on a can of roach killer carries the warning to keep the product away from the kids, does that really do any good if a user won't follow the instructions? What happens when an adult leaves a can out where children can get to it? If a child were to accidentally ingest some of the material, how many parents would know what to do? Perhaps more people should know about the prevention and cures for poisonings due to insecticides.

New laws will be passed concerning matters relative to pesticides. Some of these laws may be effective and others may not. Either way it is up to you and your parents to understand all about the safe use of pesticides. We should all understand that pesticides are made to help us, not hurt us - if they are used properly!

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DO ANTS LEARN?

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Purpose: When I think about the differences between an ant and a rat, I think mostly about basic things like body size and whether there is a tail or not. But that's not what I am focusing on. What I thought of is to see if an ant could learn.

Approach: To start out, I made a plans for a maze. Then, foods such as glucose and bread crumbs were placed at the end of the maze and an ant was placed at the beginning. The box had 24 compartments and holes were cut only between certain wells so that they formed the maze (fig. 1).

Results: After placing an ant in the maze, I measured the time it took to get to the glucose. On the first run, an ant took 82 seconds. After the first five times in the maze, the ant got progressively faster in getting from one end of the box to the other. On the fifth trial the ant only took 57 seconds. But after washing the chamber, the ants time went back up to 75 seconds. Upon re-testing (trials 6-9) the ant again required less time to get from one end of the maze to the other, until I again washed the chamber. Once more the time required increased, this time requiring 73 seconds.

Conclusions: During the first five trials it looked as though the ant had acquired the ability ("learned") to navigate in the maze. But after washing the chamber the ant seemed to "forget" what it had "learned". This evidence led me to the conclusion that the ant was not learning how to find its way through the maze, but rather was using a chemical trail. With each trial in the maze the chemical track became stronger and the ant was better able to find its way to the food. In summary, I think my experiment indicated it was a chemical track instead of learning that enabled the ant to travel through the maze.

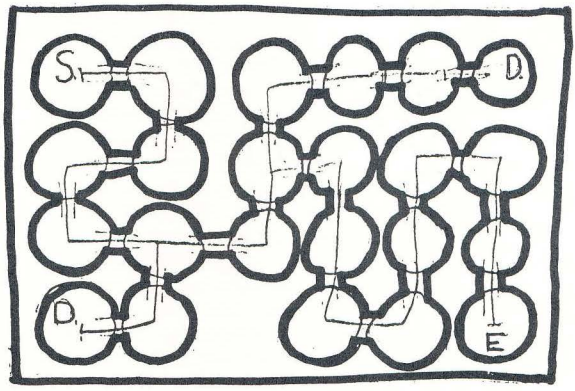

Figure 1. The ant maze.

FREDDIE THE FRIGHTENED FIREFLY

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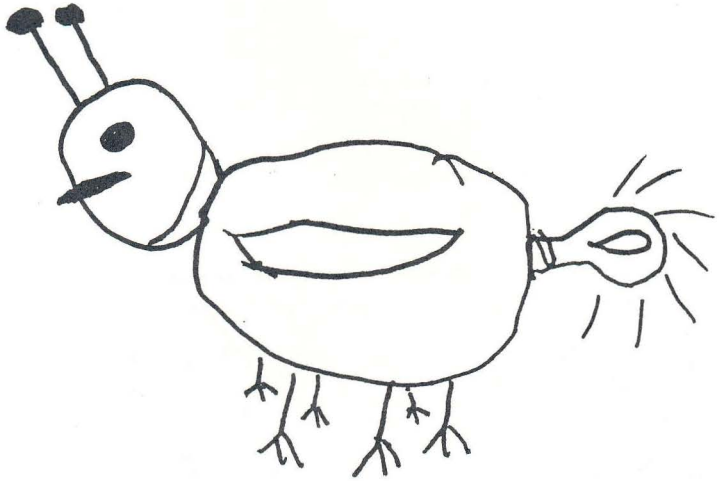
All the fireflies were out playing, but Freddie wasn't - he was hiding in a bush because he was shy and too frightened to turn on his light. The last time Freddie played with all the other firefly children his light had burned out and he was too embarassed.

Freddie flew home with droopy wings. "I'm no use to anyone", Freddie thought. All of a sudden he heard someone yelling. "Help! Help! Can someone help me cross the road?" Freddie said, "That lady really needs my help!" So he buzzed over there. "Hi, my name is Freddie. I will help you walk across the road by turning on my light." The old lady said, "Thank you Fearless Freddie."

The next day at school Freddie told his classmates what he had done. They all gave Freddie three big cheers. After that they all called him Fearless Freddie!



HOME COMPUTERS IN ENTOMOLOGY

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Tom held the insect net shut with one hand and reached into his backpack. Instead of pulling out a collecting jar he took out a pocket computer with the new Biopackage attachment. He opened the small door and slowly manipulated the small insect into the examination chamber. He then turned on the computer and pushed the key marked I.D. Within a few minutes the computer did a visual scan, including infared scanning and electron microscopy, as well as biochemical analysis of secretions and then inserted a fine needle for a sample of the body fluids. The computer buzzed and began to print the scientific name on the screen, as well as information on recent diet, current location, and weather. A menu was then displayed which gave options of everything from review of pertinent literature to preference for the type of mounting to be done. Tom decided that he would like the insect pinned as usual and a genitalia dissection and mount done. He also selected the option of having the information transmitted to his home computer by satelite. A small disk popped out of the top of the computer and a moment later a note appeared on the screen notifying Tom that research was being done on that group of insects and it would be appreciated if he would use his soil probe. He then pushed the probe into the soil and left it until the computer beeped.

Later, at home, he removed the mounted insect and the preserved genetalia and when into the lab where he was able to view a 10 foot holographic projection of his insect and its' genitalia and compare it to the holotype holograph.

Before you run to the phone and call your computer dealer, I should explain that this system is not available - yet. However, much of the technology required for this type of systen is being produced today.

There is enough that you can do with a computer today though that investing in one might be considered. There are several areas today that make (or shortly will make) computers indispensible to the entomology enthusiast. First and foremost in data processing. In this regard, data can be anything from the information on a specimen label to address lists of collectors and their interests. How long would it take you to list how much of your collection was obtained in a certain county and separate it by month collected? It would take a few seconds on a computer.

Another area of computer use just starting to come into play is communications. The most important advance for the home computer user is the bulletin board system, or BBS. Have you ever wished that you could write a letter to lots of people at once, carry out a lengthy correspondence privately within a few days, or get the latest on currect research? This is all possible with a BBS. A BBS is a computer that your computer can call on the telephone. The features of the BBS are limited only by the imagination of the system operator (SYSOP) who runs the BBS. Most BBS's are currently confined to computer interests and games, but in the near future there may be hundreds in every city (there are about 20 in the Kansas City area now). I am hoping to start a BBS on entomology in 1987.

I mostly use my computer in entomology to print labels. My printer can print half height and half width, which is just about right. Using a computer, I can get as many identical labels as I want just by typing the information once.

In the near future some developments will drastically change the scope of home computer use. The most promising of these is WORMS. WORMS stands for "write once, read many systems". This is a system that can store information on a laser disk. Each disk will hold about the same amount of information as the Encyclopedia Brittanica. Can you imagine having access to all of Seitz' "Macrolepidoptera of the World", including illustrations, on a disk the size of a 45 rpm phonograph record!

Scientific language dictionaries will make it possible to translate documents automatically into any language with little difficulty. This would revolutionize the availability of both classic and modern literature in your own language.

This is an exciting time in the evolution in the way we process information. I welcome you to consider getting involved in the revolution.

FIELD TRIP PREPARATION

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Planning a field trip to collect or observe insects? Uncertain about what you should take along to assure a successful trip? Well, here are a few suggestions of items (in the form of a checklist) that you will probably want to consider taking along.

FIELD TRIP CHECKLIST

__ killing bottle(s)
__ livestock jar(s)
__ collecting vials
__ forceps/tweezers
__ aerial net
__ sweep net
__ aquatic dip net
__ knife/hand axe
__ trowel/hand rake
__ kitchen strainer
__ assorted plastic bags
__ beating sheet/tray
__ blacklight (& sheet)
__ headlamp/flashlight
__ aspirator (& vials)
__ insect traps
__ field clothing
__ shoes/boots
__ hat
__ rain gear
__ mosquito repellent
__ map & compass
__ first aid kit
__ food/snack
__ drinking water

SPECIAL NOTE: Always tell someone you trust where you're going and when you plan to return!

NOTES ON FEEDING BEHAVIOR AND COMPARITIVE MORPHOLOGY OF MOUTHPARTS IN SCARABAEIDAE (COLEOPTERA), PART 1

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Whoever has had the opportunity to consult the rare works dealing with the external and internal morphology, as well as the function of mouth organs among scarabaeid beetles, must have observed that they generally concern a rather limited number of species of this heterogenous taxonomic group. As a result, the complex problems of so-called "morphological adaptation" have been studied only partially, and the immense diversity of structures remains unknown.

Among the earliest works dealing with the morphology of larval mouthparts of Scarabaeidae are those of American entomologists such as Hayes and Boving. In 1929 Hayes demonstrated an eminent taxonomic importance of the details of labrum-epipharynx complex in Aphodius larvae and added the elementary version of their name-study. Boving (1936), in his paper on the Plectris aliena, integrated Hayes' definitions on the base of additional structures found in the other types of larval epipharynx and proposed new terms, many of which have been applied by other authors in the descriptions of larvae (e.g. Ritcher 1945, 1947; Carne, 1950; Jerath, 1960; Lumaret and Paulian, 1972, 1974, 1977; and Stebnicka, 1978). The mouth organs, including the labrum-epipharynx complex in adults, have been illustrated and discussed by Madle (1934) in his paper on the morphology, ecology and physiology of the larvae and adults of Aphodius rufipes L. Prior to Madle's contribution, only a few authors paid attention to mouthpart structures of adults and their usefulness in comparative taxonomic research. Landin, in a series of publications (1959, 1960, 1961), has given very valuable accounts of the morphology, phylogeny and adaptation of Aphodiinae. In 1978, Dellacasa presented a remarkably clear description of the epipharyngeal structures occuring generally in adults of the genus Aphodius Illiger. Burgis (1984) dealt with functional morphology of the head of Cetonia aurata L. Finally, Stebnicka (1985), realizing the importance of the morphology of the mouthparts as a taxonomical criterion, tried to explain some adaptive dependence.

Although the broad outlines of larval and imaginal morphology of scarabaeid mouthparts have been elucidated, many of the details have still to be worked out. The understanding of a series of important peculiarities concerning the adaptation of particular species or groups of species presupposes, however, a more detailed knowledge of some morphological structures of functional importance. This is true of the larvae as well as of the adults, the mouth organs of which are structurally more or less modified, depending on ecological specialization of species to their life in various biotopes. With the extensive modification and destruction of natural environments in the modern world, it may not be possible to study adaptations even with a basis of descriptive and functional morphology, the knowledge of which will perhaps be of greatest importance for the solution of some of the fundamental problems of taxonomy and transformation. For this reason, I have for

a few years been led to investigate such a rich field, studying the mouth organs of numerous species of Scarabaeidae and of several species belonging to other families of Coleoptera.

My purpose to undertaking this subject here is to let entomologists know directly and concisely a series of facts, which I think will be useful for all students in the elucidation of many controversial problems. I shall arrange my observations in the successive chapters with a short summary brought up to date with the previous findings. I would like to interject that I prefer to continue the use of the family name Scarabaeidae in the broad sense with taxa such as Scarabaeinae, Aphodiinae, Aegeliini, etc. maintained at the tribe or subfamily level rather than raised to family status. I am of the opinion that full family status given by some authors for bigger or smaller, seemingly well separated groups of species is unjustified unless premature. Any and all scarabs are easily recognized as such so long as the name Scarabaeidae is used, but that identity is easily lost if the older subfamilies or tribes are listed similarly as in Y.E.S. QUARTERLY 3(2), page 26.

FOOD AND FEEDING HABITS

What kinds of food do scarabaeid beetles eat? Not quite everything, but a very wide range of organic substances and a few inorganic ones. A salient feature of the natural history of Scarabaeidae, both larvae and adults, is connected with the soil. The most profound relationship to soil is observed among larvae of the majority of scarabaeid species, as well as in the adults of the three largest species-groups: Scarabaeinae, Aphodiinae, and Geotrupinae. The adaptability of scarabs to a wide range of diets has led to the invasion of many specialized habitats in which they deal with an immense variety of foods in many different ways. The food requirments include proteins, fats, carbohydrates, mineral salts, vitamens and also traces of other substances. These are easily met by such a mixed diet. Thus, the feeding categories discussed in the following chapters are only a guide to the main foods of the scarabs concerned. I shall consider each of these categories separately.

(1) Coprophages. The development of coprophagy and concomitant behavior patterns of various species of Scarabaeidae are determined by ecological characteristics of the excrement-soil system, and other factors such as combination of temperature, air humidity, and light. Each patch of dung is an individual habitat with its' own community of animals which depends on the age of the dung, the environmental conditions, the time of year, etc. The dung beetles are found in nearly all kinds of vertebrate animal dung. Most dung is, in fact, mainly vegetable in origin as the largest accumulations of dung come from herbivorous mammals. These mammals eat huge quantities of grass, and some of this passes through the digestive system without being absorbed; in addition, there are bacteria and various digestive juices. The chemical composition of different kinds of dung has been treated by Muller (1926), Madle (1934) and Schmidt (1935). According to Madle, the dung beetles feed exclusively on albuminous substances in the dung. He also states that only dissolved albuminous substances, vegetable albumens and bacterial albumens, occur richly enough in the dung to serve the alimentary requirements of the adults and larvae. Furthermore, he found that the dissolved albumens of the dung are rather soon split by the influence of bacteria. In this

connection it is important to note that the larvae and the adults of some species digest not only the dissolved albumenous substances, but also bacterial albumens. The excrement of omnivores, e.g. man and pigs, is often inhabited by dung beetles, whereas droppings of carnivorous animals are only seldom and occasionally visited. The absence of vegetable substances or their inconspicuous traces in the droppings of carnivorous animals possibly explains why the coprophages avoid that kind of excrement. Through specialization to certain ecological conditions, such as abundance of rodents in semi-deserts and deserts of the Old and New World, some species became adapted to use the pellets of rodents. The same phenomenon is evident among those scarabs that use the feces of bovines and cervides. As the habitat selection of different species depends on their ability to tolerate the climatic conditions, those species which are restricted to shaded or insulated habitats are also restricted to those kinds of droppings available there. The Australian authochtonous dung beetles have profound adaptations to characteristics of marsupial pellets to the point that introduction of cattle and bovine excrements have not attracted the scarab fauna enough to exploit or destroy it. Some of the Australian scarabs are attracted to human and bovine excrements, however, they mostly depend upon the dung of marsupials. Generally, the climatic conditions of the environment and the microclimatic conditions of the soil restrict dung beetles to certain habitats, likewise as the representatives of other groups of species.

The coprophagous scarabs can be divided into two main groups of dung feeders: species utilizing coarse and solid particles of excrement (e.g larval stages of the majority of dung beetles, adult of some Geotrupinae, Scarabaeinae and Aphodiinae) and species utilizing soft and liquid contents of excrement (e.g. adults of Scarabaeinae and Aphodiinae).

(2) Saphrophages. The saprophagous species feed upon dead and decaying plants. There are a great many sources of rotting food in almost all habitats, but the carpet of shed leaves (leaf litter) of woods and brush lands is probably the greatest single source. Other dead vegetation includes logs and tree stumps, rotting fruits, nuts, mushrooms, fallen flowers and occasional accumulations of flood rubbish and piles of grass cuttings. In fact, the saprophagous free-living scarabaeid species are distributed around the world according to factors such as type of vegetation, its state of decay, amount of free water in the soil, climate and other conditions.

The saprophagous species can also be divided into two groups: species utilizing hard organic substances (hard saprophagy - term introduced by Stebnicka, 1985) such as dead wood, leaf litter, and spores (e.g, larval stages and adults of some Aphodiinae, Auclonocneminae, Geotrupinae and the members of other taxa) and species utilizing subliquid and liquid contents of decaying vegetation (soft saprophagy - term introduced by Stebnicka, 1985) such as vegetable juices, dissolved albumenous substances and/or bacterial albumens (e.g., larvae and adults of many Aphodiinae, Scarabaeinae, Dynastinae, and other taxa).

It should be mentioned that a great majority of the typically coprophagous and saprophagous species have a mixed diet. For example, the adults of a given species lick the liquid that seeps from vegetable masses undergoing fermentation, even though some individuals also occasionally consume the liquid contents of excrement. Numerous species of both groups occasionally exhibit other feeding habits, which will be discussed in the next part of this paper.

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AN INDOOR ENTOMOLOGICAL SURVEY OF HUMAN HABITATIONS IN ILE-IFE AND ITS SUBURBS, NIGERIA

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INTRODUCTION. Some sort of association between certain insects such as fleas, flies and lice and ill health of man has been recognized from antiquity, as many of man's common ectoparasites are referred to in the Bible. However, some insects do not transmit any disease but can nevertheless cause considerable nuisance and annoyance to man by their bites and stings, which may be poisonous or provoke severe irritations. Others are destructive to building structures, foodstuffs and properties.

MATERIALS AND METHODS. The survey was limited to indoors. The survey excluded nocturnal insects such as moths, winged ants, beetles, etc., which were attracted by electric lights into sitting rooms. The survey period spread over two years made up of two rainy seasons (March - October) and two dry seasons (November - mid-March).

Two houses in low-income and two houses in high-income areas were selected in Ile-Ife township for the purposes of this exercise. Two houses were also selected from three villages near Ile-Ife. This was aimed at determining the type of insects associated with the rural and urban population. Monthly routine visits were made to these houses for collection purposes.

The search for insects was carried out in rooms, parlours, kitchens, pantries, bathrooms, toilets, on house floors, roofs, walls, boxes, books, cupboards, refridgerator, water pot, beds, matresses, sinks, cracks and crevices, clothes, heads of kids, etc. In collecting ants, certain materials were used. These include a suction apparatus, beakers, and baits like jam, sugar and oil palm fruit. To collect fleas, the bodies of dogs and cats were searched. Traps were also set to catch house rats. Any rats caught were wrapped in cellophane bags and brought to the laboratory where fleas were removed.

Collected specimens were immediately identified and preserved.

RESULTS. The following insects were collected: cockroach, silverfish, house fly, mosquito, termite, booklouse, dog flea, rat flea, bean weevil, maize weevil, cricket, mason wasp, clothes moth, and four species of ant (Monomorium pharaonis, Dorylus sp., Solenopsis molesta and Camponotus pennsylvanicus).

Cockroaches were found in all the houses sampled except one of the houses from the high-income, urban area. House flies and mosquitoes were common in all houses sampled except the screened houses in the high income, urban area. Crickets were collected only from houses in the villages. Mason wasps were collected from only two of the houses in the villages, but their nests were found in all houses sampled. Clothes moths were found in the high-income and low-income areas. Silverfish and book lice were found in old books. Bean and maize weevils were found in pantries among beans and maize, respectively. Termites were found destroying door and window frames in three of the houses sampled in the villages. Ants were collected in all the houses sampled. They were collected from the floors, dining tables and by the use of sugary and oil baits.

DISCUSSION. It is clear from this study that these household insects are ubiquitous in nature and pose a serious threat to the survival of man in this part of the world. There is a need for effective control of these pests so that the health of man can be protected.

It is interesting to note that bedbugs and human lice were not found in any of the houses sampled. This may be due to the increasing awareness of good sanitation and better hygienic living conditions. This points out the fact that greater control of the majority of household pests could be achieved through improved environmental sanitation.

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Service, M.W. 1980 A Guide to Medical Entomology. MacMillan Press. 226 pp.

Holy Bible: Exodus 8: 21 and 24; Job 7: 5.

THE CICADA

Andres Escalante Tios
Merida, Yucatan
MEXICO

Some cicadas are among the biggest insects in the world, and most species achieve respectable size. The cicada Pomponia imperatoria from Malaysia has a wingspan of 20cm. The family of cicadas (Order Hemiptera; suborder Homoptera) is closely related to the aphids, leafhoppers (Cicidellidae) and scales (Coccidae).

In addition to their size and impressive appearance, cicadas are also noticeable because of their noisy singing and the long developmental periods of some species.

Cicadas have a wide, flat body and two pairs of big wings with the typical arrangement of nerve-like veins. The longitudinal veins do not extend all the way to the extremity of the wings, but leave a narrow margin along the exterior edge. The wings are normally transparent, but in some species they are colored by pigments in the membrane. The wings are not decorated with scales like in the butterflies and moths, so they can always be easily separated from these insects.

Cicadas are mainly tropical and can be found only in small numbers in the temperate climates. Some species live in southern Europe and in the United States and southern Canada. Here in the Yucatan we have about 12 species; there are 75 species in all of North America. More than 1500 species of cicadas are known worldwide.

I like these insects very much, and I have collected many of them - both as nymphs and adults. The cicadas shed their skin when they molt from nymph to adult. They move out of their skin as if it were a tiny house, and I have found many of these empty skins on rocks, bushes, and coconut trees near the sea.

GUIDELINES FOR VISITING MUSEUMS AND BORROWING SPECIMENS FROM INSTITUTIONAL AND PRIVATE COLLECTIONS

Gary A. Dunn
Department of Entomology
Michigan State University
East Lansing, MI 48824-1115 USA

One major reason for building and maintaining insect collections is because they serve as a resource to provide stored data, in the form of insect specimens (and their labels), for systematic and other entomological research studies. Although this function is somewhat archival in nature, the real value of insect collections is in their use for investigating the fascinating relationships among insect families, genera, species, and subspecies, as well as the relationships between insects and their (our!) environment.

In the course of entomological investigation and research it often becomes necessary to study large samples of certain insect groups or species. It is generally impossible to personally collect all the specimens necessary for these types of studies, especially if you are interested in morphological diversity, geographic distributions, seasonalities and life cycles, etc. It seems only natural then to turn to institutional and private collections for assistance. Most collections are willing to cooperate, and so if you wish to view and study their specimens you must either arrange for a visit or a loan of specimens. The purpose of this article is to give some general guidelines for visiting collections or requesting loans of specimens. It must be pointed out that these are not absolute rules; situations vary, and you will have to modify your approach accordingly.

VISITING COLLECTIONS. Always make arrangements for your visit in advance of your arrival. If you show up unannounced it is unlikely you will receive the assistance you need. Perhaps the curator is out of town. Perhaps the museum already has many other researchers working in the collecttion. Always give the curator (or collection manager) as much lead time as possible. When it comes time for your visit, be punctual, courteous and professional. If for some reason you must change your plans at the last moment, please be sure to inform the curator who's waiting for you to show up! It is a good idea to bring your own tools and supplies to carry out your work. Most institutions, and some private collections, will have a microscope available but its' a good idea to ask before you arrive. You should definitely bring your your own "tool kit" (forceps, probe, pen and pencil, determination labels, etc.), literature and reference books, record books or note pads, and any other specialized equipment of supplies you might require.

REQUESTING SPECIMENS ON LOAN. Loans may be requested when it is impractical to make a trip to the collection. Loans from institutional collections are usually made only to established, bonafide researchers and persons who have demonstrated a serious interest and an ability to properly handle specimens. Any students requiring a loan of

specimens should usually make their request through a teacher or faculty advisor. It is usually a good idea for students who are making loan requests to include a letter of support from their faculty advisor at the time the initial request is made.

Include specific information in your request for a loan of specimens. Explain the exact nature of your study, the exact group involved in your study (family, genus, species, etc.), and the geographic area you're interested in. You may want to offer to sort through unidentified material that is likely to contain members of your group. Requests for transcriptions of label data should not be requested; after all, it is your research project! It is, however, alright to ask if the collection contains specimens from a particular geographical area. State the length of time the loan is needed. If at a later date you cannot meet this deadline, a loan extension must be requested.

You will, of course, be expected to handle the specimens with the greatest of care and professionalism. Don't abuse your priviledge to use these valuable, often irreplacable, scientific treasures.

Generally, the following rules apply to most loan requests. Please keep in mind that these rules are not universal, and specific arrangements and conditions may be imposed by collection curators/owners as they see fit. You will have to work these out with the person in question.

(1) The shipment (mailing) of the specimens to the borrower is made at the expense of the loaner; the material is returned at the expense of the borrower. Pack and handle the specimens with the utmost of care.

(2) As a rule, holotype specimens are not sent out (they are preferably studied on site); however, portions of the paratype series may be loaned out.

(3) All previously determined specimens on loan are to be returned to the collection, unless specific arrangements have been made for an exchange or donation of the material.

(4) Representatives from series of previously unidentified specimens, on which you make determinations, may be kept if prior arrangements have been worked out. No more than 1/2 of a series may be kept, and single specimens from any locality must be returned.

(5) If a new species is identified from the borrowed material, it is generally assumed that the holotype and at least half of the paratype series will be returned to the collection. If the collection in question does not maintain type specimens or series, it should be the duty of the borrower to make specific arrangements for the deposition of the material in a suitable public collection. The lender has the right to select the final depository, but it is usually at the suggestion of the specialist /describer.

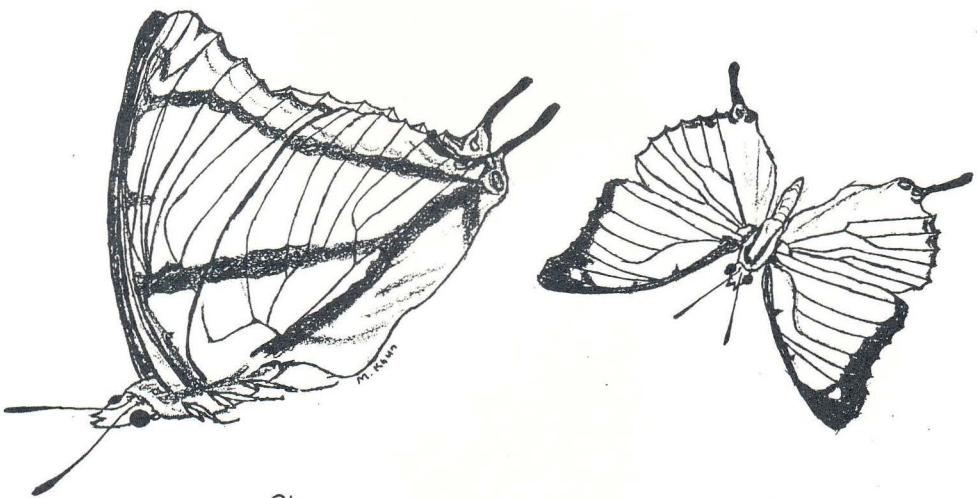
(6) If dissections of genitalia are required, permission should be requested in advance. A method for storing the genitalia should be agreed upon at or before the time the request is granted.

(7) It is customary for the borrower to place determination labels on all the specimens he/she identifies, even if correctly identified previously (this activity is known as vouchering).

(8) Labels are never permanently removed from any specimens! Any new labels that may be required are added to the pin from the bottom. If necessary, older labels may be folded so the newer label can be seen.

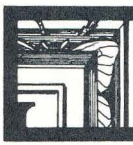
(9) The borrower should record information on all of the borrowed specimens that are retained, including number of specimens of each sex for various localities, dates, collector names, and institutions. Send a copy of this information to the lender and keep a copy for your records.

If you use these guidelines and suggestions, I am quite certain you will quickly achieve success in your endeavor to examine specimens from the collections of individuals and institutions around the world.



Charaxes kaldéni

Illustration by Mark Khun, Reno, NV (USA).



BOOK REVIEWS

The Sucking Lice of North America. An Illustrated Manual for Identification. By Ke Chung Kim, Harry D. Pratt and Chester J. Stojanovich. The Pennsylvania State University Press, 215 Wagner Buidling, University Park, PA 16802 USA, 1986, hardcover, 241 pp, US $39.95 (ISBN 0-271-00395-2).

The sucking lice, Order Anoplura, are a group of ectoparasitic insects of considerable importance because of their medical and veterinary significance in the areas of parasitism and disease vectoring. This book, "The Sucking Lice of North America", consolidates a great deal of useful information on the biology, hosts, distribution and identification of the 19 genera and 75 species of North American sucking lice.

Specifically, the book includes chapters on collecting and preparation techniques, morphology and diagnostic characters, biology and immature stages, public health and veterinary importance, illustrated keys to the North American Anoplura, and a synopsis of the North American Anoplura. The book also contains a parasite-host list, a host-parasite list, references (9 pages) and an index.

At first glance this book hardly looks like the definitive work on the North American sucking lice. Howevere, I was pleasantly surprised by this book, because I found it to be well written, not overly-technical, and well organized. The book is concise but authoritative. The illustrations by Chester Stojanovich are the most outstanding feature of the book. The illustrated key is well endowed with the necessary illustrations. Furthermore, the male and feamle of each species (and special diagnostic features) are illustrated with fine scientific illustrations. It is in my opinion the illustrations that make this book so useful to anyone interested in these ectoparasitic insects.

While not for everyone, this book is a worthwhile addition to the library of any institution or individual interested in, or working with the Anoplura of North America.

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Peterson First Guides: Insects of North America. (A Simplified Field Guide to the Common Insects of North America.) By Christopher Leahy; illustrations by Richard E. White. Houghton Mifflin Co., Boston, MA 1987 3.5 x 6.5 softcover, 128 pp, US $3.95 (ISBN 0-395-35640-7).

In my role as an Extension Entomologist I work with a lot of adults and teens interested in youth entomology. One of the most freqyuent questions I am asked is this: "What book do you recommend as a reference for beginning entomologists and their parents?" Now I finally think I have a really good answer, "The Peterson First Guide on Insects".

I think the Peterson First Guide on Insects of North America nicely fills the void between the simplest of insect guides (such as the Golden Guide series) and the more sophisticated field guides (Peterson, Audubon, etc.). In fact, as you might have already guessed, the Peterson First Guide series is an abridged (condensed) version of the famous Peterson Field Guide to the Insects of North America by Donald J. Borror and Richard E. White.

The pocket-sized guide contains sections on "introducing the insects", "observing insects", "life stages", "parts of insects", insect order charts, "some common insect-like creatures", and insects. The writing style and terminology is just right for the younger audience.

The main section of the book is devoted to the common insects groups of North America. One of the nice features of this book is that it disregards any mention of uncoomon and rare insects, and thereby helps the beginning entomologist increase confidence in his/her identification skills rather quickly. The book employs the famous Peterson Guide trademark of using arrows to point out significant recognition characteristics. Significant identification information is italicized in the text, also. The discussion on each of the insect groups (orders and large families) also includes information on life history and habits.

The guide is well supplied with fine black & white and color illustrations by Richard E. White (the same illustrations used in the Peterson Field Guide to Insects, incidentally).

In the area of deficiencies I can see a couple of small problems. The lack of even a primitive key to the orders of insects results in the reader having to scan all of the illustrations to come up with the most likely insect identification solutions. The insect order chart somewhat simplifies this task, but I would still prefer to see an illustrated key so that beginners could get accustomed to seeing and using identification keys. Additionally, the lack of size reference lines leaves the user guessing about the actual size of the illustrated specimens.

Overall I heartily recommend this new "junior field guide" to parents of budding entomologists, 4-H and other youth club leaders, and anyone who works in the area of youth entomology instruction. You definitely get your monies' worth with this book.

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TRADINGPOST

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* **INFORMATION FOR LISTEES:** Space in the Y.E.S. Tradingpost is made *
* available to members in good standing on a first come, first serve, *
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* inquiries to their listings, should be directed to Y.E.S. Inter- *
* national Headquarters, Department of Entomology, Michigan State Univ- *
* ersity, East Lansing, MI 48824-1115 USA. *
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FOR SALE OR EXCHANGE: All orders of insects, but especially Diptera & Hemiptera, from Israel. Write for details. Yitzhak Nussbaum, Nahalat-Zvi 35, Petack Tigwa 49421, ISRAEL. (2/4)

FOR SALE: Large selection of papered Malaysian butterflies, beetles, & other insects' all A-1 quality with data. Free catalog available; write to DECO Enterprise, P.O. Box 155, Taiping (Perak), MALAYSIA. (2/4)

FOR SALE OR EXCHANGE: Butterflies & moths, also some odd insects from New Zealand; also, Lepidoptera from No. America, Europe and Japan, including several much sought after western species & subspecies. John Reichel, P.O. Box 789, Revelstoke, British Columbia, V0E 2S0 CANADA. (3/1)

FOR SALE: Sphingidae, Nymphalidae, Saturniidae, Helioconidae, ithoimid sp., Caligos sp., and Morphidae; also, Automeris sp., Euchroma gigantea, Titanus giganteus, Harlequin longhorned beetles, Megasoma elephas, golden scarabs & many others. Darien Compound Safaris, P.O. Box 909, Panama 9A, REPUBLIC OF PANAMA. (3/1)

EXCHANGE WANTED: Will exchange Cicindelidae and other insects from New York state and New England for tiger beetles from any part of the USA or world. Michael A. Valenti, 105 Klondike Ave., Stamford, CT 06907 USA (3/1)

FOR SALE: Neotropical insects from northern Central America; will also exchange same for Catocala spp. (Lepidoptera: Noctuidae), esp. from Europe, N. Africa, central Asia, China or Korea. Also sell glassine envelopes in 3 convenient sizes; take fountain pen and stamp pad ink well. Eduardo C. Welling M., Apartado Postal 701, Merida, Yucatan, MEXICO. (3/1)

FOR EXCHANGE: Many spp. of butterflies from Malaysia, Philippines, Taiwan, Africa, Peru, Brazil, and Europe, all A1 quality, in exchange for A1 quality specimens from other countries (USA, Canada, Central America, South America, Australia, Indonesia, India, etc.). Exchange prefereed, but can also buy. Patrick Malesieux, 87 rue Delhaye, 59148 Flines les Raches, FRANCE. (3/1)

FOR SALE: Worldwide distributor of superior quality entomological supplies, books, and living material. Send US $1.00 for catalog. American Biological Supply Service, 1330 Dillon Heights Ave., Baltimore, MD 21228 USA, phone (301) 747-4500. (3/2)

WANTED: Coccinellidae, worldwide; will exchange or purchase. Send offers to Francesco Isgro, 2002 Wellfleet Court, Falls Church, VA 22043 USA. (3/2)

FOR SALE: Many kinds of insects from South America, for scientific studies or collections; named or unnamed, lots or single specimens, pinned and labelled or papered. Write to Luis E. Pena G., P.O. Box 2974, Santiago, CHILE. (3/2)

EXPEDITIONS: To any part of South America, to study, collect or photograph insects. Vacancies for two people and their gear in a camper. 40 years experience. Send inquiries to Luis E. Pena G., P.O. Box 2974, Santiago, CHILE. (3/2)

FOR SALE: Worldwide Lepidoptera, also some Coleoptera. Top quality, papered specimens, with complete data. Good prices. Satisfaction guaranteed. I also sell Elephant brand insect pins. Send US $1.00 and SASE (business size) for price list. Your $1 is refunded with the first order. Thomas A. Greager, R.D. #6, Box 56-B, Greensburg, PA 15601 USA. (3/2)

PUBLICATIONS FOR EXCHANGE: I have a large selection of duplicate reprints and photocopies of articles on Coleoptera (Carabidae, Cicindelidae, Buprestidae, Scarabaeidae, Curculionidae, etc.) that I would like to exchange for literature on Carabidae or Cicindelidae, or any reasonable offer of specimens from these same two families. For a free list, or additional information, contact Gary A. Dunn, Department of Entomology, Michigan State University, East Lansing, MI 48824-1115 USA. (3/3)

CORRESPONDENCE WANTED: I am interested in making contact with anyone interested in tarantulas, with a view towards exchanging and buying live specimens, and exchanging information. Ronald N. Baxter, 45 Chudleigh Crescent, Ilford, Essex, IG3 9AT ENGLAND. (3/3)

WANTED: Looking for a used (or mint) copy of Hatch (1953), Beetles of the Pacific Northwest; Darlington (1952), The Carabid Beetles of New Guinea, Part 1 AND Part 2 (Agoniini). Send condition and price to Yves Bousquet, Biosystematics Research Institute, Agriculture Canada, Ottawa, Ontario K1A 0C6 CANADA. (3/3)

COLLECTING SAFARIS: Experience the splendor and beauty of the tropical rain forest. We offer some of the finest safaris available. Your vacation and collecting trip in one package! For brochures and information contact Darien Compound Safaris, Special Travel and Tours, P.O. Box 909, Panama 9A, REP. of PANAMA. (3/3)

WANTED: Wings from various flying insects for use in macro photography work. I can use whole insects (even with damaged bodies, antennae, legs, etc.) or just wings. I am a naturalist and not an entomologist, so any help would be greatly appreciated. Helmuth Schulz, Jr., 1582 US 131, Petoskey, MI 49770 USA (3/4)

WANTED: Person interested in exchanging specimens of Carabus, Calosoma, and Ceroglossus, worldwide, but especially from No. America. I can offer many European and Turkish spp. Write to Carl L. Blumenthal, Kiefernstr. 21, D-5210 Troisdorf, WEST GERMANY. (3/4)

FOR SALE: Dried specimens of Philippine insects; also, other natural history specimens such as bird skins, mammal skins, prepared microscope slides, preserved marine invertebrates, etc. Please contact Julio M. Mirafuente, General Manager, Star Biological Supply Co., Boac, Marinduque, PHILIPPINES. (3/4)

EXCHANGE WANTED: I have many insects (especially Coleoptera) available from Trinidad, Venezuela, Europe and the SW USA, for Carabidae & Cicindelidae of the world. Especially interested in obtaining Australian, Asian and African spp. All letters answered. John Hutchings, Dept. of Biology, California State University, Long Beach, CA 90840 USA. (3/4)

FOR SALE: Insects (esp. butterflies, moths, beetles, hoppers, and stick insects) from Malaysia. Catalog, US $2. Contact Kee Choe Gooi, 70 Jalan Foo Win Yin, Canning Garden, 31400 Ipoh, MALAYSIA. (3/4)

FOR EXCHANGE OR SALE: Approx 500 spp. of Coleoptera: Cerambycidae, Carabidae, Buprestidae, Tenebrionidae, & Cetoniidae. Free list. Prefer to exchange. Dr. Diethard Dauber, Neubauzeile 78, A-4020 Linz, AUSTRIA. (3/4)

FREE PUBLICATION: "Insect Rearing" by Pritam Singh, DSIR Alpha Publication No. 53. Anyone interested in insect rearing will want a copy of this 4pp bulletin. Send requests for single copies to: Publication Officer, Science Information Publishing Centre, DSIR, P.O. Box 9741, Wellington, NEW ZEALAND. (3/4)

FOR SALE OR EXCHANGE: North American Cicindelidae. Will also trade other Coleoptera for Cicindelidae. Contact Todd Lawton, 29-61 Furby, Winnipeg, Manitoba, R3C 2A2 CANADA (3/4)

FOR SALE: Excellent quality insect mounting pins, incl. standard black, elephant, & stainless steel. Best prices available. Also offering the most popular books, supplies and specimens. Worldwide butterflies, moths and beetles in all price ranges. Send US $5.00 for subscription to price lists. Ianni Butterfly Enterprise, P.O. Box 81171, Cleveland, OH 44181 USA. (3/4)

EXCHANGE WANTED: Beetles & moths of NE USA for similar insects from your area. Mainly interested in Lucanidae, Scarabaeidae, Cerambycidae & Carabidae. Jeff Frey, 364 Oaklyn Road, Lebanon, PA 17042 USA. (4/1)

EXCHANGE: Coleoptera, esp. Cerambycidae (worldwide). Please write to Gontran Drouin, 50 Principale, Ste Henedine, Quebec, G0S 2R0 CANADA. (4/1)

INFORMATION WANTED: I am very interested in the pharmaceutical applications of scorpion venom, and would appreciate hearing from anyone with information or an interest in this subject. Frederic LeCorre, B.P. 6, 34820 Teyran, FRANCE. (4/1)

WANTED: Specimens of Chalcidoidea, esp. Torymidae, worldwide. Will trade for various insects from Florida (USA). Would like to correspond with any youth or amateur entomologists in Florida, esp. for the purpose of studying certain gall insects. Contact Dave Johnson, 345 Entomology Bldg., University of Florida, Gainesville, FL 32611 USA. (4/1)

WANTED: Would like to trade No. American beetles, mainly from the midwestern USA, for specimens from other parts of No. America. I like to deal in pinned specimens only. If interested, please contact me and I will send a list of what I have available. B. L. Buchli, P.O. Box 187, Deerfield, WI 53531 USA. (4/1)

EXCHANGE: Stamps, worldwide. Daniela Havranek, U.N.E.T., Apartado 436, San Cristobal, Tachira, VENEZUELA. (4/1)

FOR SALE: Video cassette (Beta): "Pests of Cruciferae of Venezuela" (in Spanish), 15 min. Pests and integrated control. Costs 500 Bs plus postage (300 Bs to USA, 400 Bs to Europe; approx. 20 Bs = US $1.00), immediate delivery guaranteed. Write checks to D. Izera and mail to Daniela Havranek, U.N.E.T., Apartado 436, San Cristobal, Tachira, VENEZUELA. (4/1)

WANTED: Data on Plutella xylostella (L.), worldwide. Dr. Pedro Salinas, Apartado 552, Merida, VENEZUELA. (4/1)

EXCHANGE OR PURCHASE: Formicidae (ants), worldwide. Dr. Pedro Salinas, Apartado 552, Merida, VENEZUELA. (4/1)

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INFORMATION NEEDED BY Y.E.S. HEADQUARTERS: Members with information on INSECT ZOO anywhere in the world are requested to send details on location(s), institutional affiliation(s), and mailing address(es), if known, to Y.E.S. International Headquarters. The information will be used in the upcoming revision of the "Y.E.S. International Entomology Resource Guide". Any information will help! Send to: Gary A. Dunn, Y.E.S. International Headquarters, Dept. of Entomology, Michigan State University, East Lansing, MI 48824-1115 USA. (4/1)

LOST AND FOUND: A manuscript without an author's name on it had been found at Y.E.S. Int'l HQ. It is entitled "Lepidopteran Protection" and is typed on green and white computer paper. As soon as the author can be identified the paper will be published in Y.Q. Contact Gary A. Dunn, Dept. of Entomology, Michigan State University, East Lansing, MI 48824-1115 USA.

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FOR SALE: Entire worldwide stamp collection including album. Album contains 3000 mounted, mostly used stamps; will add an additional 2700 stamps sorted to country. Most are unique with few replicates. Great addition to collection or as a gift. Asking US $65.00 or best offer for all. Also asking US $5.00 for collection of 125 fine grade Lincoln wheat and memorial cents (1941-1973) in handsome album. Donald Baumgartner, 150 S. Walnut St., Palatine, IL 60067 USA. (4/2)

NEW SPRING CATALOG: Specimens from S. America, Africa, mainland China, Indonesia, Europe, etc. Rare Morphos from Guyana, Brazil, Peru, Colombia, Bolivia, Mexico, Trinidad, & Argentina. Parnassius listing (on request) including China, Europe, etc. Low prices, prompt delivery. Send US $1 for catalog, or $6 for years catalogs issued monthly. Transworld Butterfly Co., Apartado 6951, San Jose, COSTA RICA. (4/2)

NEW BOOK - BUTTERFLIES OF COSTA RICA AND THEIR NATURAL HISTORY. First comprehensive coverage of Costa Rican Papilionidae, Pieridae & Nymphalidae. 560 spp. in color with natural history data. An excellent book, published Feb. 1987. To order, write to Transworld Butterfly Co., Apartado 6951, San Jose, COSTA RICA. (4/2)

SPECIAL T-SHIRT OFFER: Best quality, 100% cotton, with Costa Rican toucan and parrot designs. Small/medium/large sizes. Colors: white, grey, yellow, or blue (state alternate color). $9.45 each (add $1.50 for shipping). Order two shirts and get free shipping! Send check or money order to Transworld Butterfly Co., Apartado 6951, San Jose, COSTA RICA. (4/2)

INTERNSHIPS AVAILABLE: The Lloyd Center for Environmental Studies is seeking two interns, one for the summer and one for the fall session, to assist with a continuing light-trap survey and to help develop population and distributional surveys of state listed rare Lepidoptera (Massachusetts). Housing and a small stipend are provided to interns. Applicants should have completed their sophomore year in college. Starting dates are May 18 and September 8. For information contact Mark J. Mello, Research Coordinator, Lloyd Center for Environmental Studies, 430 Potomska Road, South Dartmouth, MA 02748 USA. (4/2)

WANTED: Dryopidae and Elmidae (Coleoptera) of the world: exchanges and assistance with determinations. Write to Witold W. Wiezlak, Nowowiejska 39/10, 02-010 Warszawa, POLAND. (4/2)

FOR SALE: Unique collection of holarctic Dytiscidae: 440 species, 4000 specimens, all pinned, labeled and determined. Send for a list. Will also include 220 basic works on Dytiscidae of the world (excluding Africa), free. Write to Witold W. Wiezlak, Nowowiekska 39/10, 02-010 Warszawa, POLAND. (4/2)

WANTED: Information or correspondence with entomologist(s) concerning recent studies on Formicidae social interactions. primarily chemical pheromones. Please contact: Steve Dobson, 423 Cool Springs Drive, Camden, SC 29020 USA. (4/2)

RESEARCH NOTICE: I am interested in establishing correspondence with anyone who has collected, studied, or reared butterflies of the Celastrina group in North America. I can exchange butterflies from my area for Celastrina specimens and data from other regions. Contact Harry Pavulaan, 1919 N. Daniel Street #201, Arlington, VA 22201 USA (703) 841-9765 (4/2)

POGONOMYRMEX LITERATURE WANTED: A colleague and I are compiling an annotated bibliography of the harvester ant genus Pogonomyrmex and are seeking primary and secondary literature references (as well as actuals reprints or photocopies). We especially seek references to the Latin American fauna. Please send any materials or correspondence to William H. Clark, Museum of Natural History, College of Idaho, Caldwell, ID 83605 USA. Your assistance is appreciated. We are also seeking literature on all ant subjects as well as determined ant specimens for our Museum Collection. (4/2)

WANTED: Persons interested in exchanging Cerambycidae from the SE USA, including the Florida Keys, for Cerambycidae from other areas. Would especially like to correspond with persons from Europe, Australia, Japan, and Africa. All letters answered. Roy F. Morris II, Rt.1, Box 80, Milner, GA 30257 USA. (4/2)

EXCHANGE WANTED: Coleopterist from Czechoslovakia would like to establish contact with interested individuals for the purpose of exchanging specimens of Cetoninae (Scarabaeidae). Especially interested in obtaining a number of species from America, Africa and Madagascar to complete research collection. Desiderata and exchange lists available. Contact Dr. Ing. Karel Rataj, Janackova 65, 787 01 Sumperk, CZECHOSLOVAKIA. (4/2)

INFORMATION WANTED: The International Insitute of Agroforestry Systems for Development is interested in developing a butterfly farm in the USA as a prototype for use in Central America and Africa. Any Y.E.S. members with information, suggestions, or advice on undertaking such a project are asked to contact Dr. Carol Cross, IIASD, Rt 2., Box 46A, Monticello, AR 71655 USA. (4/2)

FOR SALE OR TRADE: Sphingicampa heiligbrodti (Saturniidae) from pupae. Will sell or trace for scarabs. Dan Sundberg, 4026 Colonial Sun, San Antonio, TX 78244 USA. (4/2)

BEETLES FOR THE ASKING: Will send examples of Texas Coleoptera (with data and ID) to serious young enthusiasts who are starting beetle collections. Will accept donations of scarabs, equipment or money. Other offers will be considered as well. Dan Sundberg, 4026 Colonial Sun, San Antonio, TX 78244 USA. (4/2)

INFORMATION FOR AUTHORS

Manuscripts and original artwork on any insect or Arthropod-related topics are welcome for publication in Y.E.S. QUARTERLY. There are no page charges. Articles with special interest to youth and amateur entomologists may receive publication priority, but otherwise manuscripts are used on a first come, first serve basis. Manuscripts should be typed (double-spaced), or neatly and legibly written. Photographs (black & white only), drawings, maps, charts, graphs, are encouraged; they should be done in black ink and proportioned so as to fit the 6 x 9 inch format. All authors should supply a title for their article, captions for any illustrations, and a complete mailing address. Whenever possible, state both a common name and scientific name for any species mentioned in articles. Also, for the benefit of members living in other countries, please identify state/province and country when giving locality information. Receipt of all manuscripts will be acknowledged, and they will be subject to minor editing, as necessary. (Sorry, but page proofs cannot be furnished.) NOTE: One paper from among those published will be selected as the "outstanding paper of the year" and the author will be suitably recognized.

Other features, such as news, letters to the editor, field notes, book reviews, and poems, are also welcome, and all of the previously mentioned rules apply. Members are also entitled to submit short "advertisements" for inclusion in the Tradingpost section, describing special desires for information, correspondence, specimens, or publications. All ads should be brief and concise, and should include a complete name and address; also, please specify the number of times you wish the ad to appear! Acceptance and publication of ads is made on a first come, first serve, space-available basis. Refer all manuscripts, ads, inquiries, or questions to Y.E.S. INTERNATIONAL HEADQUARTERS, Department of Entomology, Michigan State University, East Lansing, MI 48824-1115 USA. Thank you.

CONTENTS

..... CONTINUED ON INSIDE BACK COVER .....